60TH YEAR

AUGUST 1990 **$2.50 U.S.** / $2.95 CAN.

SCIENCE FICTION analog SCIENCE FACT®

PAUL ASH
The Hornless Ones

Dr. ROBERT L. FORWARD

ARTHUR C. CLARKE

0 387168 3 08
36003

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

MAIL ★ ORDER ★ MALL

▼ INFRAVIB INFRARED HEAT MASSAGER

The infravib Massager is good news for your aches and pains. This state of the art device combines infrared heat and a powerful wand massager in one unit. Deep penetrating Infrared has two settings and gives fast temporary relief to sore joints and muscles. Massager soothes and relaxes tired and aching muscles. Massager has a long flexible shaft with four massaging attachments (body, acupoint, leg and foot, and scalp) and two massage levels. Try Infravib—it might be just what the doctor ordered. **$89.98** ($6.25) #A1952.

▼ HEALTHMATE

Health conscious people are concerned about monitoring and promoting their own health and well-being. The Healthmate-Electronic Finger Tip Blood Pressure Monitor lets you monitor your blood pressure quickly and easily. Simply inset your left finger into the finger cuff and wait sixty seconds for the digital readout of your blood pressure and pulse. The unique adjustable cuff design gives a customized fit to all finger sizes. The unit, which is portable and lightweight, automatically inflates and deflates to give accurate blood pressure readings. Don't let your blood pressure be a dangerous secret. Make a healthly choice to know the "score". Healthmate makes self-monitoring of blood pressure possible for everyone! Battery included. **$152.98** ($6.00) #A1951.

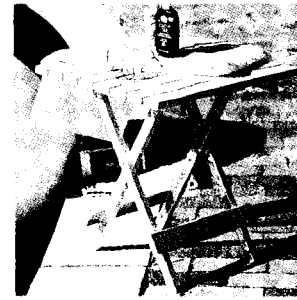
◄ LAMBSWOOL DUSTERS

Lambswool contains a natural static charge that makes dust literally leap off surfaces. This magnetic attraction is just the thing for dusting off bric-a-brac, china, crystal, pictures, anything. Our dusters are imported from England. They are the fluffiest, highest quality lambswool in the world! We offer a set of four lambswool dusters: our 27" duster, our telescoping duster which extends to more than four feet— lets you reach high corners, top shelves, overhead lights and collapses to 28", and two mini dusters for extra fragile objects. **$22.98** ($4.00) #A1870.

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

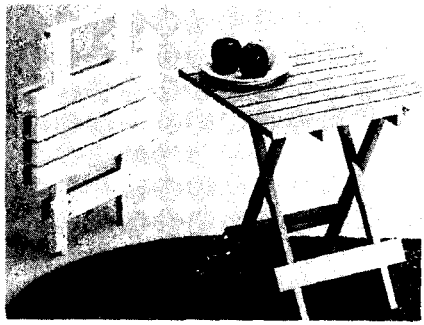
▼ QUIK-FOLD® — A TABLE ON THE GO

Simply grasp the edges of this clever patented table — the top separates, the halves flip down and a convenient handle appears from nowhere! Weighing just 8 pounds, it totes easily wherever needed; lift the edges and it's instantly positioned. 21" tall, it has a 19½"x21½" surface with plenty of room for snacks, plant display, games, you name it.



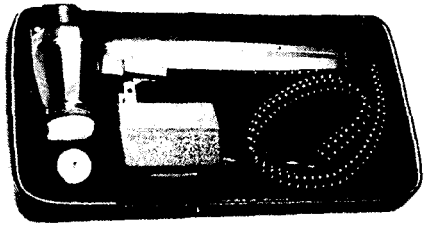
POOLSIDE ►

INSIDE ◄



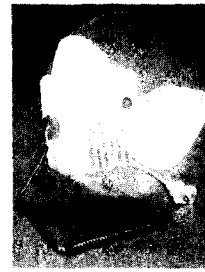
The fact that the durable styrene is the kind used for football helmets indicates its strength and impact resistance, plus it's entirely water-safe in kitchen, bath or outdoors. Three attractive colors are molded in, not painted — so no peeling or chipping. Specify Off-white, #A1831; Slate Blue #A1832; Red, #A1833. Any color just **$19.98** ($6.50).

▼ TREAT YOUR TIRED MUSCLES SUCCESSFULLY!



The Novafon Sonic Massager from West Germany boasts over one half million users in Europe and hundreds of sports trainers, physiotherapists, health clinics and physicians recommend the Novafon worldwide. That's because mixed frequencies of sound (up to 10,000 oscillations per second) penetrate 2¼" beneath the skin to stimulate blood circulation and relax stressed muscles. Made of light metal alloy, and with no moving parts to wear out, it's completely safe. 7½", 8oz., 14" coiled cord extends to 6 ft. Comes with 1 flat, 1 rounded washable head, handsome carrying case. 1 year warranty. NOVAFON SONIC MASSAGER **$135.98** ($10.00) #A1953.

▼ MIGHTY LITTLE FAN



The most important qualities of a household fan are safety, quietness, portability and force enough to get the air circulating. We've found a little powerhouse of a fan that meets all these criteria admirably. This two-speed fan is completely safe — if the spin of the soft plastic blades is interrupted, the fan stops without so much as marking a finger. The blades measure 7". We offer this fan in white for **$21.98** ($4.00) #A1604. Two for **$38.98** ($5.00) #A16042.

TO ORDER: Send check with item number for total amounts, plus shipping & handling shown in ( ) payable to **MAIL ORDER MALL**, Dept. 080 AN; PO Box 3006, Lakewood, NJ 08701, or call TOLL FREE **1-800-365-8493**. NJ residents add 6% sales tax. We honor MasterCard/Visa. Sorry, no Canadian, foreign, C.O.D. orders. Satisfaction Guaranteed. 30 day money back guarantee for exchange or refund. Allow 30 days for delivery.

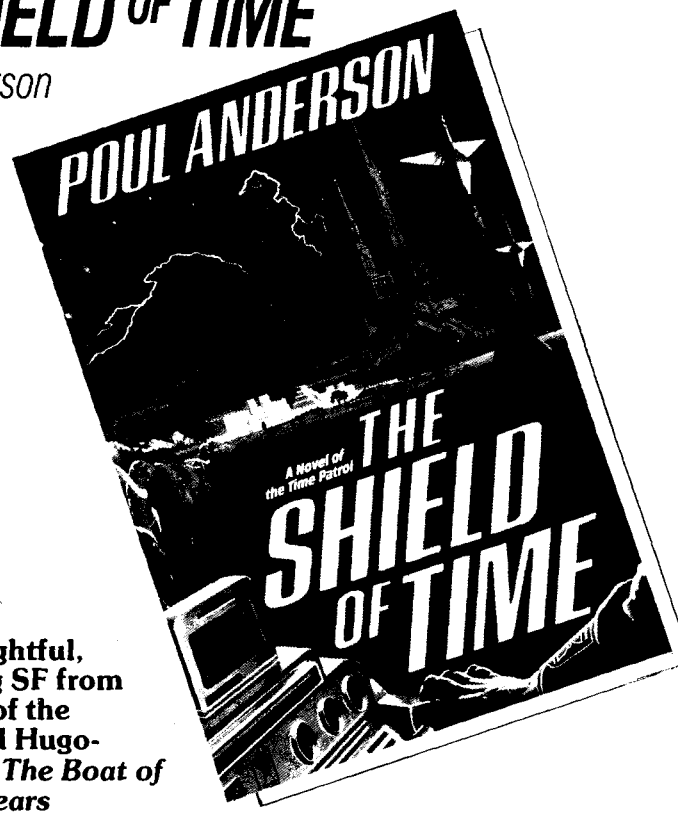
Magalog Marketing Group Inc. © 1990
1905 Swarthmore Ave., Lakewood, N.J. 08701

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

T O R P R E S E N T S

THE SHIELD OF TIME

Poul Anderson



Vivid, thoughtful, fast-moving SF from the author of the Nebula- and Hugo-nominated *The Boat of A Million Years*

Authoritative in detail yet headlong in pace, THE SHIELD OF TIME is time-travel as only Anderson can tell it—an unalloyed treat from one of SF's living legends.

THE SHIELD OF TIME is the first full-length novel in the masterful "Time Patrol" series, a story cycle countless Anderson fans have been faithfully following for thirty-five years. As such, it is a major event for readers of classic SF.

"Poul Anderson is science fiction's premier historian, past, present, and alternative!" ***—The Detroit News***

From Tor Books 85088-3 • $18.95 • August

TOR

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

analog

Vol. CX No. 9
August 1990

Next issue on sale
July 24, 1990

Novellas

THE HORNLESS ONES, Paul Ash ____ 12
LORD OF FISHES, Bernard Deitchman ____ 150

Novelettes

RETURN OF THE ALPHANAUTS, J. Brian Clarke ____ 74
ADAM AND EVIL, Joseph H. Delaney ____ 118

Science Fact

THE NEGATIVE MATTER SPACE DRIVE, Dr. Robert L. Forward ____ 59

Short Stories

FIREWORKS IN ORBIT, Marianne J. Dyson ____ 93
MATCHMAKER, Thomas A. Easton ____ 104

Special Feature

IF IT CAN BE DONE, NATURE'S DONE IT ALREADY, Arthur C. Clarke ____ 71

Probability Zero

SCHRÖDINGER'S LIFEBOAT, Jerry Oltion ____ 112

Reader's Departments

THE EDITOR'S PAGE ____ 4
IN TIMES TO COME ____ 92
THE ALTERNATE VIEW, G. Harry Stine ____ 114
THE REFERENCE LIBRARY, Tom Easton ____ 143
BRASS TACKS ____ 187
THE ANALOG CALENDAR OF UPCOMING EVENTS ____ 192

Cover by Todd Cameron Hamilton

Joel Davis, President & Publisher

Stanley Schmidt
Editor

Tina Lee
Managing Editor

Terri Czeczko
Art Director

Indicia on Page 6

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

Editorial

BAG LIMIT

Stanley Schmidt

My local newspaper recently ran a feature article headlined, "The Great American Bag Race," which I found both interesting and amusing in ways that neither the author nor the editor probably intended. The subject was the relative merits of paper and plastic grocery bags; the discussion included the reasons why many customers and grocers vehemently prefer one or the other, and the fierce economic competition between manufacturers of both.

Just a few years ago, practically all grocery stores in this country routinely stuffed a customer's groceries into paper bags. In the early Eighties, plastic bags began to replace them in some places. By the time I sat down to write this, the two competitors were running neck and neck, with roughly equal numbers of paper and plastic bags in use. Some stores offer only one or the other, but many have found it worthwhile to offer a choice. Some customers prefer paper because they stand upright and are biodegradable. Others prefer plastic because of their handles and waterproof character, and point out that while they don't biodegrade as well as paper, landfills tend to slow down decomposition anyway and plastic bags take up less room in them. Grocers tend to favor plastic because it's cheaper, and bags are the largest single supply cost for supermarkets.

The article I mentioned reached no clear conclusion about which kind of bag was better overall, but it made clear that *both* kinds of bags contribute to the ubiquitous problems of resource consumption and solid waste disposal. The difference between them in terms of environmental impact is one of degree—and, when you come right down to it, pretty trivial. Ironically, neither the author nor anyone quoted in the article even hinted that there might be another option that offers much more significant advantages over *either* kind of bag.

Could it be, I wondered, that despite

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

all the currently fashionable talk about Let's Be Kind to the Environment, most Americans have little interest in finding answers that make a *real* difference? Or is it just that they've forgotten, and forgotten how to imagine, that such answers may exist, and may even be almost laughably simple?

Grocery bags, it seemed to me, are one of the more obvious examples of such a case. If you want to reduce the problems of depleting materials to make them and later finding ways to get rid of them, the choice is not between paper and plastic.

The choice is between *disposable* and *reusable*.

Almost all Americans have come to take it for granted that every time they go to a store, the clerk will give them as many bags (made of *something*) as it takes to hold whatever they buy. According to the article I've mentioned, for groceries alone this averages 143 bags per person per year. But I know a few Americans who, during times of depression or wartime shortages, made or bought durable *cloth* bags which they could take with them every time they went shopping—and kept using them for years, or even decades. Until recently (when American ideas of throwaway convenience began to seep across the Atlantic), generations of Europeans took it for granted that they must provide their own containers for their purchases.

So there's plenty of historical proof that it can be done—and the potential environmental impact is *enormous* compared to the rather laughable "choice" between disposable plastic and disposable paper. Every bag of *any* kind consumes materials and energy for its manufacture, and eventually uses some combination of space and energy to dispose of it when it's no longer considered useful as a bag. A family of four, using disposable bags at the rate cited in that newspaper article, will incur these costs and problems for some 5,700 bags over the course of ten years. The same family could carry the same groceries in five or six well-made canvas bags that could easily last the entire decade.

Look again at those numbers: five or six bags, *total*, versus five or six *thousand* to do the same job. Choosing plastic or paper bags on every trip to the store might reduce resource consumption and disposal requirements by a few percent. Choosing durable bags that seldom have to be replaced can reduce them by three orders of magnitude.

Which looks like a real choice to you?

An immediate reaction to the radical suggestion that both kinds of disposable bags should be generally replaced by very durable reusables might be, "It would put bag boys out of work!" But of course it wouldn't, really. Bag boys can fill a bag that I bring in every week just as easily as they can fill a new one every week. (Actually, bag boys seem to be disappearing anyway. Relatively few stores in my neighborhood still have separate people to stuff bags—in part, at least, because automatic price scanners now allow one person to ring up items and bag them in one motion.)

A more serious objection might be all the less obvious people whose jobs

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

would disappear. If you drastically reduce the market for bags, you will indeed reduce the need for people to make bags, and to collect and process raw materials for them. If you take measures to reduce the amount of petroleum you refine and the number of trees you cut, you will indeed reduce the amount of employment available in doing those things.

But is that a big *problem*—or a big *opportunity?*

When a person, or a people, gets very much accustomed to doing things in a particular way, it becomes easy to lose sight of what is a means and what is an end. Basic human needs, for example, include food, clothing, and shelter. Our society has, over a very long period, evolved a mechanism for satisfying those needs that depends on a complicated system of exchange. When you strip away the obscuring details, the essence of it is that nobody can have those things unless somebody does the work of producing and distributing

STANLEY SCHMIDT ..... Editor
TINA LEE ..... Managing Editor
IAN RANDAL STROCK ..... Assistant Editor
TERRI CZECZKO ..... Art Director
ANTHONY BARI ..... Junior Designer
CAROLE DIXON ..... Production Director
CYNTHIA MANSON ..... Director of Marketing and Subsidiary Rights
FLORENCE B. EICHIN ..... Manager, Contract & Permissions
VEENA RAGHAVAN ..... Director, Special Projects
CHRISTIAN DORBANDT ..... Newsstand Marketing and Promotion Manager
DENNIS JONES ..... Newsstand Operations Manager
ELIZABETH BEATTY ..... Circulation Director
BRIAN McKEON ..... Corporate Business Manager
A. BRUCE CHATTERTON ..... Advertising Director
LISA FEERICK ..... Advertising Coordinator
IRENE BOZOKI ..... Classified Advertising Manager

Published since 1930.

JOEL DAVIS
President and Publisher

CARL BARTEE
Vice President
Manufacturing

JOE DEFALCO
Vice President
Finance

First issue of *Astounding* January 1930. ©

ADVERTISING OFFICES
NEW YORK
(212) 557-9100

Analog Science Fiction/Science Fact (Astounding) is published every 28 days with special issues in January and July by Davis Publications, Inc. at $2.50 a copy in U.S.A., $2.95 in Canada. 1 year subscription for $34.95 in the U.S.A. and possessions, in all other countries, $39.65 payable in advance in U.S. funds. First copy of new subscription will be mailed within eight weeks of receipt of order. When reporting change of address allow 6 to 8 weeks and give new address as well as the old address as it appears on the last label. Second-class postage paid at New York, NY, and at additional mailing office. Canadian 3rd class postage paid at Windsor, Ontario.

© 1990 by Davis Publications, Inc., all rights reserved. Protection secured under the Universal Copyright Convention. Reproduction or use of editorial or pictorial content in any manner without express permission is prohibited. All stories in this magazine are fiction. No actual persons are designated by name or character. Any similarity is coincidental. Printed in U.S.A. All submissions must be accompanied by stamped self-addressed envelope; the publisher assumes no responsibility for unsolicited manuscripts or artwork.

POSTMASTER: SEND to ANALOG SCIENCE FICTION/SCIENCE FACT (ASTOUNDING) P.O. BOX 7061, Red Oak, IA 51591.
IN CANADA RETURN TO 1801 SOUTH CAMERON, WINDSOR, ONT. CANADA N9B 3E1
Editorial and Advertising: Analog Science Fiction/Science Fact, 380 Lexington Avenue, New York, NY 10017
Subscriptions: Analog Science Fiction/Science Fact, P.O. Box 7061, Red Oak, IA 51591 **ISSN 0161-9398**

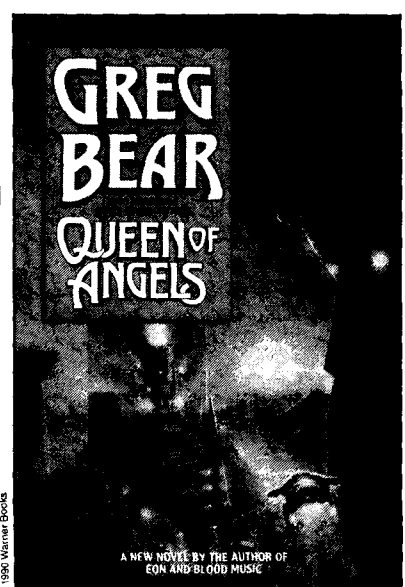
LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

ON A CLEAR DAY, YOU CAN SEE TOMORROW.

In a brilliantly conceived novel that rivals the legendary *A Clockwork Orange*, SF master Greg Bear creates a future world that is transformed—and transfixed—by timeless questions of perfection, punishment, growth, and the true nature of the human soul. It is a singular world that exists less than a century away...

"Whether he's tinkering with human genetic material or prying apart planets, Bear goes about the task with intelligence and a powerful imagination."
—*Locus*

- A Book-of-the-Month Club Alternate Selection
- A Preferred Choice Bookplan Alternate Selection



WARNER BOOKS
A Warner Communications Company

A WARNER/QUESTAR HARDCOVER

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

them—so we employ people to do the work, and in return give them currency with which they can purchase the products they need. Employment is a means to two ends: for the individual, it's a way to keep food on the table and a roof over the head; for society, it's a way to insure that enough food and roofs are produced.

The problem—the *real* problem—is that most of us have come, at least subconsciously, to regard employment not as a means to those ends, but as an end in itself. Therefore when technology reduces the amount of work required to satisfy human needs, we react in a truly bizarre fashion: instead of inventing new ways to distribute needed things to people who no longer have to work as hard to produce them, we invent new ways to make work for people to do! Wasteful, ultimately self-destructive ways, like making and throwing away 6,000 shoddy bags to do the work of six good ones—and in the process making millions of people spend most of their waking lives doing tedious things that don't need to be done at all.

Bags are just one example. The philosophy of "dynamic" or "planned" obsolescence has pervaded much of our culture, with products of almost every description being deliberately designed to fall apart in a relatively (and unnecessarily) short time. What if the "canvas bag" approach became a basic tenet of our general philosophy? What if it became common practice to build *everything* to last? What if the entire country suffered an epidemic of pride in workmanship, so that everything we bought had a useful life two or three or a thousand times what we now expect?

Well, you may say, that would be terrible. We'd have a perfectly appalling welfare problem. But is that *really* what we'd have? Imagine a complex of technological advances and/or attitude changes that reduce the total amount of work that needs to be done by 50%. That *may* mean that 50% of the workforce is thrown out of jobs and onto welfare—but only if you insist on being locked into a system that sees *N* hours of employment per week as something that Everyone Must Have. If you and your culture are imaginative and flexible enough, it may instead mean that everybody can stay employed, and still be paid enough to live comfortably, but only needs to spend half as much time on the job—and has that much more time free to do things he or she *wants* to do.

Yes, it requires some restructuring of society—but isn't it worth it, especially when you consider the alternative? And the question is *not* purely hypothetical. The numbers are, but the essence of the situation is very much the one we're actually in. The culture has even shown *some* signs of responding to it—the "normal" work week *has* been reduced significantly in the last century—but the response is painfully slow and awkward. We're still so committed to "full employment," even if the definition of the term has changed slightly, that we waste enormous amounts of energy and materials and human potential doing work that not only needn't be done, but *shouldn't* be done.

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

Join the Crossword Puzzles of the Month Club and put your crossword skills to the test!

Become a member and receive five intriguing, fun and challenging new puzzles — mailed right to your home every month! These are not reprints, but *original, full-size* puzzles edited especially for our members by the noted crossword puzzle expert Henry Hook. Month after month, you'll receive five brand-new puzzles and their solutions . . . five fiendishly clever puzzles with the same degree of difficulty as those in the Sunday New York Times!

Join today! A perfect gift!

An entire year's membership is just $29.95. (We pay the postage.) Send your check or money order to:

Crossword Puzzles of the Month Club
629 Green Bay Road, Dept. 206
Wilmette, Illinois 60091

Or call toll-free: 1-800-433-4386
and charge it to your MasterCard or Visa.

Your satisfaction is guaranteed.

©1989, CPMC

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

This can't go on indefinitely. We will *have* to find ways to cut the waste, and better ways to match goods to consumers, more realistically geared to real needs and present capabilities. The more quickly and smoothly we can achieve that, the better it will be for everybody.

It won't be simple or easy; but then, important, worthwhile things seldom are. One complication that will need to be considered is the fact that not all kinds of work can be redistributed—"spread thinner"—with equal ease. If we cultivate the habit of building things to last (and, as consumers, taking care of them so they last), this clearly suggests a shorter work week as the norm in manufacturing occupations. But what about teachers, doctors, research scientists, or artists? Such occupations require such special personal qualifications that there may not be many more people to share in them, so it's a little hard to see how their workload might be reduced. In fact, it might well tend to increase, with a growing population of people having more free time and wanting to learn new things to do with it. On the other hand, people in such occupations tend to *like* their work, and might want to continue devoting large amounts of time to it anyway. Might such conditions lead at last to more respect and better pay for good teachers? Might more people having time to spend on education even raise the general level of intellectual interests, abilities, and activities? Maybe, just maybe—if things are handled right.

What about progress? If most things are built for durability, might this make it harder to sell new, improved devices, and thereby destroy much of the incentive to develop them? At least some of that effect is probably inevitable, but I'm not sure how much. Nor am I sure it's entirely a bad thing. Much as I admire and appreciate worthwhile innovation, it sometimes seems that much of what actually happens is a frantic and rather mindless chasing of fads, a perennial pursuit of The Latest Thing for no better reason than that it *is* The Latest Thing. The result is that most Latest Things come and go quickly and make no lasting contribution except to landfills.

Maybe it wouldn't be such a bad thing to slow change down just a bit, to take at least a temporary breather and give people a bit more time to learn to live *well* with what they have rather than constantly hurrying on to something newer that they dimly hope might be better. Besides, many of the real advances happening now deal with information handling and are not very materials-intensive. I see no intrinsic reason why we couldn't move toward sturdier houses and cars and clothes—and grocery bags—and at the same time toward better and better information systems.

In any case, it's high time more people were looking beyond short-term difficulties and trivial choices to see how we might best take advantage of the future. Often—and certainly in many matters that face us now—a situation looks like a "problem" rather than an "opportunity" only because we're not imaginative enough about "solutions." ■

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

THE BEST OF THE YEAR

L. Ron Hubbard Presents WRITERS OF THE FUTURE®
Volume VI

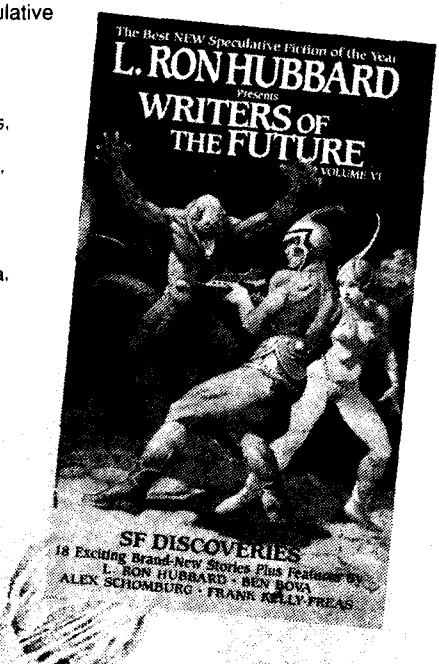
18 Award-Winning Short Stories — this year's winners from the International L. Ron Hubbard's Writers of The Future Contest.

Experience a bold new universe of variety, insight and entertainment in these 18 award-winning short stories by the brightest emerging stars in speculative fiction. Includes 18 contest-winning illustrations.

Selected by:
Gregory Benford, Ben Bova, Algis Budrys, Ramsey Campbell, Anne McCaffrey, Andre Norton, Larry Niven, Frederik Pohl, Jerry Pournelle , Robert Silverberg, John Varley, Jack Williamson, Roger Zelazny; Edd Cartier, Leo and Diane Dillon, H.R. Van Dongen, Bob Eggleton, Will Eisner, Frank Frazetta, Frank Kelly-Freas, Jack Kirby, Paul Lehr, Ron and Val Lakey Lindahn, Moebius, Alex Schomburg, William R. Warren, Jr.

"The best-selling SF anthology series of all time."
— Locus Magazine

"If you buy only one paperback in the SF field this year, make it this one."
— Memphis Commercial Appeal


The Best NEW Speculative Fiction of the Year
L. RON HUBBARD
Presents
WRITERS OF THE FUTURE
VOLUME VI
SF DISCOVERIES
18 Exciting Brand-New Stories Plus Features by
L. RON HUBBARD • BEN BOVA
ALEX SCHOMBURG • FRANK KELLY FREAS

BUY AND READ

L. Ron Hubbard Presents
Writers of The Future
Volume VI
$4.95 wherever fine paperbacks are sold!

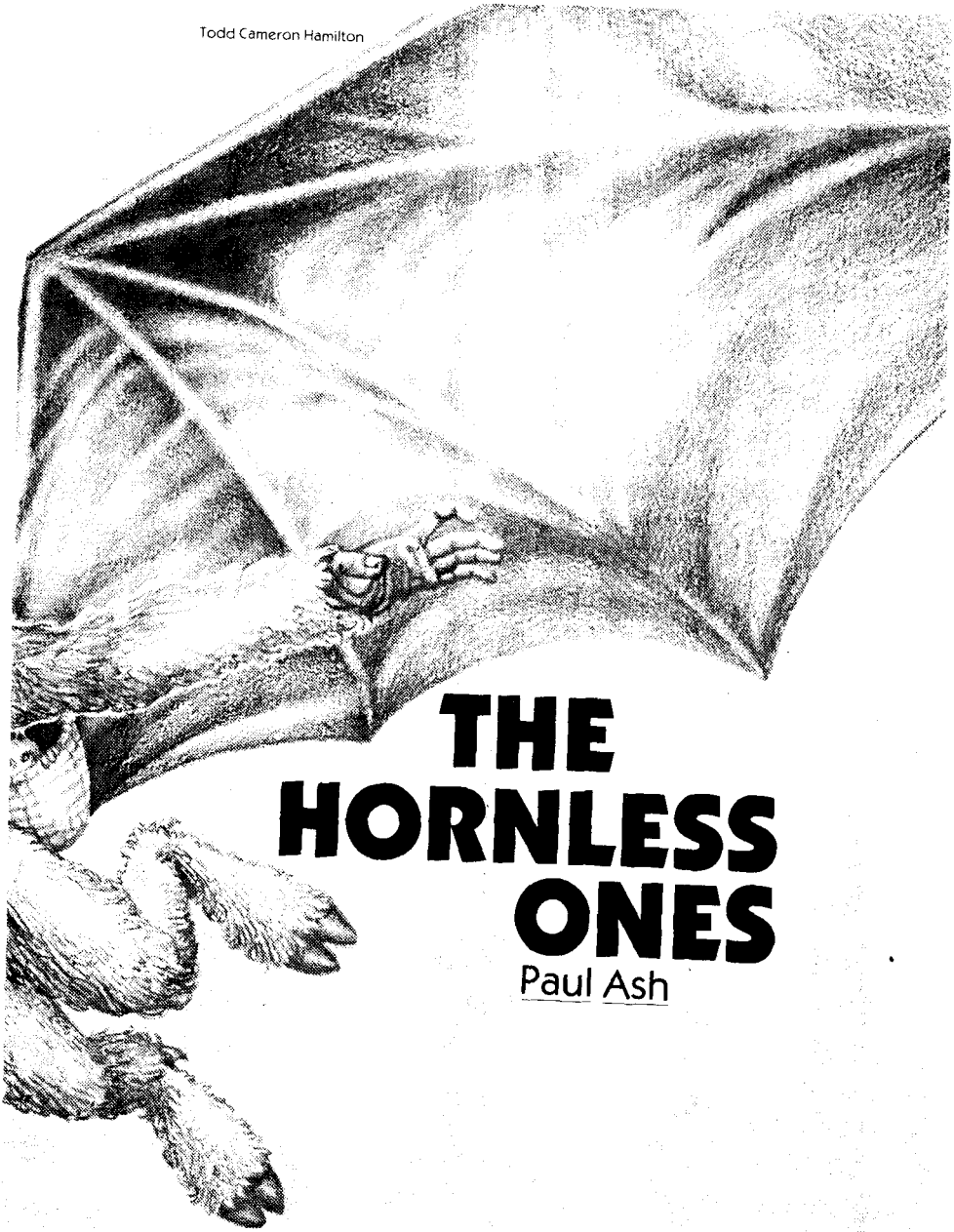
Credit Card Orders Call
TOLL FREE: (800-722-1733
(1-800-843-7389 in CA)

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

A responsible engineer must try to foresee the consequences of his work—which is never easy, and is especially difficult when what you create has a mind of its own!

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

Todd Cameron Hamilton



THE HORNLESS ONES

Paul Ash

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

"If you do that again," sundry Mothers in Onetree Eyrie said to Nyc Livelong, not once but many times before his wings were grown, "the Hornless One will come on his Flying Iron and carry you away."

On the first occasion Nyc was too young to know what it meant. The stars whose appearance had marked the beginning of his Birth Season had not yet returned to the sky; in the reckoning of forgotten Earth he was barely two years old.

He was forward, however, in sin as in other matters. Somehow he had eluded the watchfulness of the six Fledglings on duty in the KinderCave, surmounted the two feet of vertical rock between the entrance and the floor, although it was twice his own height, and trotted across the Launching Pad towards the Edge. He had come so close to it that the Mother who retrieved him developed palpitations as soon as she had time for them, and was unfit for duty all the rest of the day. Before this, however, she uttered the threat about the Hornless One.

When he failed to react, she slapped him.

It did not really hurt, but Nyc was startled and mortified. The resulting roar brought several other Mothers, on the run. He was seized, shaken and hustled back to the Cave, where the Fledglings who had failed to keep him inside it suffered bumpy weather for the rest of the day.

Nyc was puzzled and upset. Before, whenever he had done something clever, the resulting attention had been wholly enjoyable. When he came out with his first clear word—*Nyc*—weeks ahead of the other pointlings, all the Mothers in the Eyrie had competed to groom him. It was the same when he showed that he could balance unsupported on his own hooves without falling down. Now he had taught himself to get where he wanted to go as his elders did, by putting one hoof in front of the other, but instead of having his fleece combed and a soothing scratch on the itchy place where his horns were pushing through, he got slapped.

Disapproval. Disgrace.

He decided not to do it again.

At Nyc's age, however, the present moment was too engrossing for memory to get much of a look in. Word had got round among all the Fledglings that to leave him to his own devices was to go looking for bumps. As a result, Nyc found that he had a personal attendant all to himself. He took full advantage of this and enjoyed it very much.

Two days after his breakout he was sitting on the lap of his current slave, an X in her fourth orbit, full grown—quite three feet tall. She in turn was sitting on a boulder oiling his hooves. So placed, he could look through the Cave mouth and see not only the usual patch of sky but a good deal of the Launching Pad.

Out there something interesting was going on.

Nyc's vocabulary had fewer than twenty words in it and *obstacle* was not one of them. This did not prevent him from recognizing one when he met it. He had dealt with the high sill of the Cave entrance by means of a sitting-log,

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

which had taken him half a day to push into position, a few yards at a time.

Then he had just wanted to look at the vast and fascinating panorama of the land below the Eyrie, full of rivers and trees and the racing shadows of clouds. He had seen it several times, from the arms of one of the Mothers, but never for very long; nor had he been allowed to touch it, even when he saw a herd of animals there, small enough to hold in his hand. . . . The event on the Launch Pad was new. This made it urgent and called for a different approach.

He tugged gently at the Fledgling's ear. Then he pointed.

"See," he said.

The Fledging's eyes widened. She stood up, and tried absently to settle his hooves on the top of the boulder. Nyc curled them up under him and clung to her fleece. After a couple of tries she gave up, shifted him to her hip and made for the mouth of the Cave.

Outside, one of the most important events of the Eyrie's year was getting under way. It was the season when wing-buds appeared on the yearlings' shoulders, and this day half of the current group were about to be inducted into the Mystery of the Air.

Nine of the strongest Flyers—seven Ys, two Xs—were gathered on the Launch Pad, with flowers and ribbons plaited into the long hair of their hocks, and stone-seed clappers tied round their wrists and legs.

Each in turn came forward and crouched in front of the Mother of Mothers. The fan-like sheafs into which the many-jointed wings were compacted swiveled outwards, while other adults strapped on a little saddle and tugged at it to test the firmness of the girths. When they were satisfied the Flyers rose, stretched, and leaped into the air, clappers resounding; then began to caper about—a test of the saddle's firmness, made into a display of agility or a comic turn, according to the performer's mood.

Meanwhile, a hanging balance had been set up and each of the yearlings was being weighed against a big stone. The Mother in charge, a Y, was adept at picking the right one; it was only twice that he had to make a second choice. The stone was then enclosed in a wicker framework and strapped into the saddle.

The Flyer ran to the Edge. His wings lifted. The leading edge shot out into a long zig-zag; the wing-skins and the four finger-struts seemed to emerge from it as they unfolded. For a moment the whole structure lay loose and drooping on the air; then all the joints of the edge-finger clicked into place. With twenty feet of long narrow wing springing from each of his upper shoulders, the Flyer launched himself into the air.

Soaring, swooping, twisting and occasionally turning loops, the Flyers showed off their nerve and skill, and also tested the accuracy with which the saddles had been set over the center of balance.

Nyc watched, enthralled. The Fledgling had seen it all before, three times—had taken part in it as a yearling herself. Now she was old enough to have practiced regularly in flight harness, with long leashes held by two strong Flyers. Her first solo flight would be coming any day now. She watched at first with critical interest, but soon

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

went off into a daydream wherein she herself swooped and somersaulted, free at last in the element she had been born for. . . .

Nyc had already been shifted from her hip to the broadest part of the rocky sill. He was aware of the exact moment at which she forgot about him. He kept still; there was no advantage in getting down, he could see better where he was.

One by one the Flyers stooped towards the Pad, cupped wings, and came in to land. Catchers stood waiting, but the first five judged it perfectly, touched down with both hooves and dropped to a crouch without sliding an inch. The stones, in their basket-work, were unfastened and set aside; one by one the appropriate yearlings were led forward, pale with excitement and/or apprehension, and strapped in their place.

This time there was no more stretching and bending than was strictly necessary to make sure the straps were firm; then the Flyers trotted smoothly towards the Edge, wings already spread, and floated gently away. Each stroked softly along to the nearest thermal and began to soar.

The sixth Flyer misjudged his landing slightly and there was a telltale screech as his hooves skidded. The Catchers prevented a fall, but the damage was done. The youngster being led forward dragged back and began to cry. The Catchers joined the group trying to comfort him.

The Flyer, stone already removed, crouched, waiting. Nyc saw his chance. He slid neatly out from under the Fledgling's hand, dropped to the Pad and trotted across it as fast as he could. All the other adults were still gathered around the tearful yearling. Nyc threw himself into the saddle, pushing his legs loosely into the grips on either side, and poked the Y sharply on the back.

"Go!" he shouted.

The Flyer very nearly obeyed. What saved him was a gap in his bodily memory; he had not felt the straps of the saddle being fastened around his passenger. He rose half way, then stopped and called a question.

The last Flyer to make a test flight was engaged in a daring loop, and the Fledgling had lost herself in a fantasy of flying beside him. It was so real that she felt the draught of his wings, the pull of gravity in her own flight muscles, the touch—

She did *not* feel the point of Nyc's upper shoulder beneath her hand.

She gazed unbelievingly at the rocky sill of the Cave mouth, where he should have been. Where he was not. Her eyes darted to and fro. There was a knot of adults surrounding some kind of trouble—*Nyc?* She was over the sill herself, and running. Then movement caught her eye as the Flyer started to rise; and hesitated. The yearling on his back struck angrily at him; unheard-of behavior; *Nyc!*

She panted alongside and grabbed him.

For the second time in three days Nyc Livelong was at the center of attention. Even when the two Catchers pushed everybody else off to the side so that the next Flyer could land, the rest of the Eyrie was gathered around Nyc. The frightened yearling, who had been coaxed halfway to complacence, began crying again. Nobody paid any attention.

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

FULL COLOR GRAPHIC NOVELS

THE NEW DIMENSION

BELL'S THEOREM
Trilogy of Schultheiss
$10.95 ea.
37 62 74
Medical experiment turns nightmare in parallel world.

ABOMINATIONS
by Hermann
$9.95
Short horror stories. 80

FIRES
by Mattotti $12.95
Mystical possession ends in expressionist inferno. 48

MAGICIAN'S WIFE
by Charyn/Boucq $14.95
45 Werewolf wife is victim of magic.

FALL OF THE HOUSE OF USHER
and other Poe tales by Corben
$10.95
13

GODS IN CHAOS and **WOMAN TRAP**
by Bilal $12.95 ea. 49 50
Paris, 2020, Egyptian dieties struggle for power.

MAGIC CRYSTAL
by Moebius/Bati
$6.95
S&S quest for young adults. 67

VULCAN'S FORGE and **THREE SUNS OF VINA** by Leloup
$6.95 ea. 65 76
Teenage heroine in detailed technological sci-fi adventure.

TIME TRAP
by Jacobs $8.95
For all ages.
Will he get out alive? 66

MAIL ORDER TO: ANALOG MAGAZINE
Dept. 890, 380 Lexington Ave., New York, NY 10017

NAME _____

ADDRESS _____

CITY _____ STATE _____ ZIP _____

You do not need to use this coupon if you need more space

Please send me the graphic novels circled below:

13 37 45 48 49 50 62
65 66 67 74 76 80

Please add $2 postage/handling per book; NY orders add 8.25% sales tax. Please send check/m.o. only. Do not send cash. Allow 6-8 weeks.

TOTAL ENCLOSED: $ _____

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

The shouts of the Catchers, demanding to know whether any more yearlings were to fly or not, finally broke things up. The Fledgling got hold of Nyc's hand and marched back to the KinderCave so fast that he nearly lost his footing. She lifted him on to the sill.

"The Hornless One will come for you, all right, one of these days," she said grimly. "It'll be welcome to you at this rate."

The folk of the Eyrie set no store by rules for their own sake. The few that applied to youngsters were designed to keep them out of danger. If Nyc could break them and survive there was not much point in making a fuss. Despite this the Hornless One was invoked against him, by some exasperated elder, at least once per season; but it never came.

Nyc was surprised, therefore, to learn around the middle of his fourth orbit, that there really was, or at any rate had been, a Hornless One; who was also wingless and had no hooves on its feet. When he further learned the part that this being had played in the history of the Eyrie's folk, he was astonished. The more he thought about it, the more puzzled he got.

Three days later, in the evening, he went to the Ologist and asked to have it explained.

In the Eyrie most Xs became Mothers at their tenth orbit, even the one or two who had never born young. Ys could do so if they chose, just as some Xs chose to remain hunters; but when their strength faded many Ys preferred to set out on a last flight, ending in aerobatics that were literally heart-stopping.

As a result there were no aged Ys in the Eyrie, with the exception of the Ologist, who was older even than the Mother of Mothers; so old that nobody could remember even hearing about a time when he had been young. His fleece was as white as a waterfall—it was an honor to be allowed to groom him—and his horns seemed to have gone soft, drooping down the sides of his head instead of standing out sideways, like most Flyers's.

The Ologist had never been very good at hunting; or even, by the standards of the Eyrie, at flying. His strength was in his head. He knew everything of importance that had ever happened to the folk of the seven Eyries. He made it his work to remember things, and think about them, and sort out the parts that really mattered; and of recent years to choose certain youngsters to whom these could be passed on.

Once in every orbit he would gather all the Fledglings together and tell them the history of their people. His method was simply to recount events, quite succinctly, and then stop. Sooner or later, the brighter ones would come and ask questions. They were more likely to remember facts that once, even briefly, they had really wanted to know.

"The Hornless One," he said, in his soft, toneless mumble—he had lost all his teeth many orbits ago—"It brought us here, in a Flying Iron, from another world. Yes. It *was* the Hornless One who made us able to fly."

Nyc had thought that it must be a mistake.

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

"But then it was *good,*" he exclaimed.

Very slightly, the Ologist shook his head.

"But . . ." Flying was the reason for existence, the most important thing in the world; Nyc had known that before his wings started to grow.

The Ologist shifted a little on the down-filled leather cushion that made the rock bearable to his sparsely-covered bones.

"Take a monkey," he said. "You've seen them."

"Yes." Hunters sometimes brought a young one up from the forests below.

"How would you give one wings?"

"I—" Nyc stared at him. "I could not do that," he said.

"If you were very clever—even cleverer than you are," added the Ologist with a faintly malicious smile, "and knew how it could be done; what would you need to do?"

Nyc frowned over it for a while. You would need to get the wings—from a big bird, perhaps?—and find out how to fix them on, and—

"Monkeys only have one shoulder on each side," he said. "We have two. One for arms, one for wings. Even pointlings have two."

"Correct. You would have to change the shoulder bones, and then make the wings fit the upper shoulder as ours do. How do you think the monkey would feel while you were doing that?"

Nyc had never spent much thought on monkeys' feelings, or even on his own, but he tried.

The monkey would be frightened, he thought. And when its shoulders were changed it would feel . . . strange. He remembered the feeling when his own wings' buds broke through. At least *he* had been told what was happening. For a monkey it would be more like the moment when Nyc first began to know the shape of the air.

It had come upon him quite suddenly; the feeling of being enclosed by distant and ghostly boundaries which were not always there. According to the Mother to whom he finally confessed his bewilderment, it was through his half-grown horns that the new sensations came, although when he covered the horns with his hands the feeling was still there. He was not fully used to it even yet.

"When the Hornless One gave wings to our Firstmothers, were they afraid?" he asked.

The Ologist considered for a moment.

"If I tell you how it was done, as far as I know it myself, can you sit quiet and not interrupt?"

Nyc thought about this. "If it does not take too long," he said cautiously.

"I will be brief. . . . When the Hornless One came to this world, it came alone. Those who were to be our foremothers were not yet born. What came with it was a supply of eggs."

About to interrupt, Nyc remembered, and was quiet. He knew about eggs. The One Tree for which the Eyrie was named had established itself in a crack in the rock, not far below the Edge, and a colony of birds nested there each year. At the right season you could look straight down into the nests and see first eggs, then chicks. But the young of the Eyrie came out of Xs bellies, in the GyneCave, where younglings were forbidden to go.

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

It was one prohibition Nyc had not tried very hard to get around. He did not understand how the pointlings got out, but it was not in a shell. He knew that much.

"The eggs of Xs are very small," explained the Ologist. "Normally they grow inside the X who is their birth-mother; but the Hornless One put them to grow in a kind of pot, with special waters to replace the birth-mother's blood. Then, when they were large enough to work on—though not large enough to be born—it changed them.

"At the start, it did not know all that was needed to give them proper wings. It tried one way, and another way, to see what would happen, and threw away the mistakes and tried again. That way a great many died, but there were always more eggs. In time it made creatures with wings, that lived long enough to be born, but they never learned to fly. Those were not killed; it kept them and changed them again, using cutting irons and other things. Those that did not die it kept, and made them work for it."

Horror, more than his promise, kept Nyc silent.

"In the end," continued the Ologist quietly, "it learned to make younglings, born as we are without wings, but able to grow them when they were old enough. Six of them, three Xs and three Ys. It took them to a high place like the Eyrie, though this was not one of the Eyries we know, and told them how to fly. When they were old enough they mated, and the young were like them, and grew, and flew, and had young also. And they thanked the Hornless One, as it taught them to do, for the gift of flight.

"When the eldest children of the children of the first Flyers became old enough to mate, the Hornless One took two of them, an X and a Y, back to the Flying Iron. This was like many small caves one above the other, full of strange things."

Nyc had pictured the Hornless One's Flying Iron as a long hollow rod, with saddles set along it, like the ones from which yearlings got their first taste of the air. The picture that replaced this was somehow ominous.

"The next day it fixed small irons to different parts of their bodies and made them do many kinds of things. They began to be afraid. Then it shut them into one of the small caves inside the Flying Iron and went away.

"They tried to get out and could not. But later, when it was dark, one of the spoiled Flyers came and unfastened the door. There were five of them still alive. They told the young Flyers the tale that I have told you.

"The young Flyers had learned already that the Hornless One was to be feared. They said, "What shall we do?" For if they escaped, they knew the Hornless One would come after them, and there were other, smaller flying irons which could travel faster than their wings.

"The spoiled Flyers knew where these were kept, and how they could be spoiled, so that the Hornless One could not come in pursuit. But they told the young Flyers that it would mend them again, and therefore they must move all the Folk to another Eyrie, far away and hidden, as soon as they could.

"The great Flying Iron stood on low ground among trees; there was no place

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

there for a Flyer to take off. The spoiled Flyers led them up from one cave to another inside it, and opened a hole in the wall. The young Flyers said farewell to them and flew back to the Eyrie in the dark, and that was the first time they ever found the way solely by the shape of the air, while they could not see.

"When the Folk in the Eyrie heard the tale told by the spoiled Flyers they did not believe it. There was talk all the rest of that night. Next day, as soon as the first sun shone into the Cave mouth, the two oldest Ys flew off to find the Hornless One, taking the young Y who had been to the Flying Iron as a guide. But as they circled to land they heard screaming, and one of the spoiled Flyers staggered away from the Iron with blood on her back and tried to run away. The Hornless One came after her holding a kind of iron that they had not seen before. It spat red light at the spoiled one, and she fell dead; and the Hornless One kicked the body.

"The Flyers turned to go, but the Hornless One saw them and the iron in its hands spat red light again and struck one of the older Ys, burning a small hole in his side. They all dropped to fly just above the treetops, where the Hornless One could not see them, and they flew back to the Eyrie and told the folk that the tale had been true. The next day they fled; all except the wounded Y, who died.

"In the days that followed they fled from one crag to another; one of the Ys would go in search of the next hiding place while the others hunted. After the third move the sound of the small flying iron was heard in the sky. Whenever they heard it they hid. At the fifth move they came to a crag with many caves but no Launch Pad, so that the Hornless One would not be able to land even the smallest of the flying irons, and there they stayed.

"The small flying iron was heard for many days after that, but one day it was silent and did not come again. And some days after that there was a great roar of wind, and the big Flying Iron rose from among the trees and departed into the sky.

"And now I am tired. Bring me water to drink, and then go."

Nyc went into the Day Cave. The front was in full sun, but bamboo tubes of water were stored in the cool at the back. He filled a shell cup, carried it back, said his thanks, and turned to go.

"Your name," said the Ologist suddenly. "Nyc Livelong; is that right?"

"Yes," said Nyc.

The Ologist was silent for a while, mumbling over his thoughts.

"The Hornless One," he said finally, "gave names to the Flyers he made, and to their young. We have kept those names, one or two in each of the Eyries; when the named one dies the name is given to the next pointling born. . . . Yours is one of them. The young Y who went to the Flying Iron bore it first. See you live up to it."

"And remember," said the Mother of Mothers, "water is heavy. Crowsnest Eyrie have to haul buckets fifty yards on the wing, during the dry season. It would be worth an extra half-day's flight to find a fall like ours."

Flyers's metabolism was designed to conserve water; body wastes were thoroughly dehydrated and stored in a di-

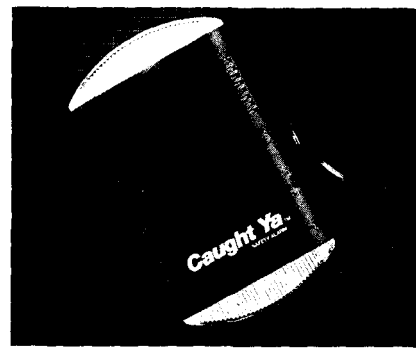
LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

MAIL ★ ORDER ★ MALL

▼ FOR ROADSIDE PROBLEMS

A compact carrying case of polyethylene with snap lock comes complete with the most-wanted emergency aids. First, an up-to-date battery charger that plugs into another car's cigarette lighter — easier and safer than the old jump start cables. There's a powerful 12-V spotlight with lighter plug and red reflector, plus two 15-minute safety flares (approved in 50 states) — plus a 24"-sq. distress flag. A tank-to-tank gas siphon pump, a 6-qt. bag for carrying water, a roll of plastic tape for emergency repair of hoses and wiring, a coil of wire and 4 elastic trunk tie-downs complete the kit. Clean up with a moist towelette (4 provided) and you're on your way 11¾" sq., **$21.98** ($4.00) #A1826X.

▼ CAUGHT YA™



This mouse-sized alarm roars like a lion when activated by its light-sensitive electric eyes on each end. Carried in your closed purse, it will surprise a pickpocket—but when *you* open it, a flick of the delay switch allows time to remove your wallet without activating the alarm. In attache,file or desk drawer, it "catches"snoopy intruders. Placed in medicine cabinet,under sink or other areas storing substances dangerous to children, Caught-Ya will sound the alarm for safety. It even tells on cheating dieters when refrigerator door is opened. 4½" × 3¼" × ⅞", it's also a handy flashlight. Takes one 9-volt battery (included). **$22.98** ($4.00). #A1782X.

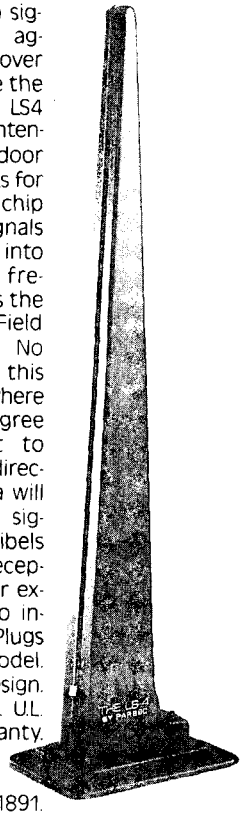
▼ ODOR AND STAIN ELIMINATOR

Mother Nature knows a lot about cleaning. In her realm bacteria produce enzymes that devour all manner of organic wastes. Now put this natural cleansing/purifying principle to work in your home. With the pet out system you can eliminate all the stains and lingering odors caused by animal accidents. Also works as a bathroom, laundry and general all purpose cleaner. Works on mildew and perspiration. 2 18oz. aerosol cans of OUT STAIN ELIMINATOR and 2 16oz. squeeze bottles of OUT ODOR ELIMINATOR: **$24.98** ($4.25) #A1881.

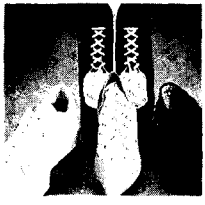
LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

▼ THE BEST RECEPTION EVER!!

Eliminate radio signal fade and aggravating cross over signals that garble the sound. The new LS4 omni-directional antenna is the only indoor antenna that thinks for itself. The micro chip brain receives signals and isolates them into individual clear frequencies. Features the Gallium Arsenide Field Effect Transistor. No need to redirect this antenna. Leave it where it is and its 360 degree radius allows it to receive from any direction. This antenna will boost your radio signals up to 24 decibels for the clearest reception you have ever experienced. Easy to install, light weight. Plugs into any stereo model. Unique modern design. Made in the U.S.A. U.L. listed. 1 year warranty. Dimensions: 3" x4.125" x 17.25". **$58.98** ($5.25) #A1891.



▼ STINKY PINKYS



Just put a Stinky Pinky "sock" in each shoe and overnight odor is gone, absorbed by the special blend of all natural earth materials. Works in running shoes, sneakers, boots, leather shoes, anything that goes on your feet. And keeps on working, too—just put Stinky Pinkys out in the sun for a day every three months or so to restore their odor-catching ability. Three pairs of Stinky Pinkys, enough for 6 shoes or boots, costs **$19.98** ($4.00) #13263.

▼ THE AQUARIUM THAT FITS ANYWHERE!

Create a relaxing mood anywhere with this extra quiet Mini Hex™. It's smaller than most aquariums and hold a gallon of water so it fits where others won't. Use this Mini Hex™ in the office, kids room, anywhere. You'll love the calming affect and aquariums have been approved to relieve stress. Acrylic tank and hood with built-in lamp (4 to 7 watt bulb not incl.). Undergravel filtering systems keep your water cleaner and clearer longer. 110-120v air pump, complete set-up and maintenance instructions. Lifelike greenery and free fish food. Made in the USA. **$24.98** ($5.75) #A1934.

HOW TO ORDER

CALL TOLL FREE, 24 HOURS A DAY, 7 DAYS A WEEK

1-800-365-8493

CUSTOMER SERVICE CALL 201-367-2900

SATISFACTION GUARANTEED

30 Day Money Back Guarantee For Exchange or Refund

WE ACCEPT MASTERCARD/VISA

If ordering by mail send remittance to **MAIL ORDER MALL**, Dept. 080 AN P.O. Box 3006, Lakewood, N.J. 08701. Item price is followed by shipping and handling in ( ). Be sure to add both together to arrive at total price. N.J. residents add 6% sales tax. When using credit card — include account number, exp. date, signature. Sorry, no Canadian, foreign or C.O.D. orders.

Magalog Marketing Group Inc. © 1989

1905 Swarthmore Ave., Lakewood, N.J. 08701

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

verticulum where, about once a week, a tough coating was secreted around them ready for disposal. Thus sanitation was not a problem. Their bodies lost water only in breath, and the amount in food was enough to replace this, except when they flew. Then the rate of breathing quadrupled and so did the water loss.

They needed a certain amount of water, therefore, for drinking as well as cooking, washing the young until they learned not to spill food on their fleece, and cooling off in summer. Onetree Eyrie was blessed with a permanent waterfall less than a wing-span from the Pad. A stout rail had been rigged around it, on which a bucket ran; a spur of rock on the far side allowed a Flyer to stand there and pull the bucket under the fall, after which a Fledgling could haul it back to the Pad and empty it into jars. Flyers visiting from other Eyries were openly envious.

Three days earlier the Mother of Mothers had made an announcement. After the last Birth-season the Caves were full. It was time to locate a new Eyrie, so that the old one could split, and both have room to grow.

This of course was no news. The Flyers had been discussing the problem for a couple of orbits at least. The Mother of Mothers had timed her announcement for the season when game was plentiful and a depleted band of hunters could provide for the Eyrie's needs. According to custom any Flyer who chose was now free to take off and explore, provided he returned in time to help with the stockpiling of food against the season of high winds and heavy rains.

Four Flyers had declared the intention of doing so. Three were young Ys who had seen only one mating season; the fourth was three times their age, but nobody questioned his decision. Nyc Livelong was a law to himself.

The Eyries—there were seven, unless one of the others had split during the last orbit—were perched along one side of a huge high table land, rather below its rim. Each of them overlooked at least one deep wooded valley, which, with the plain beyond it, was that Eyrie's main hunting-ground.

For half a day's flight around Onetree Eyrie the country had been so thoroughly studied that Flyers were expected to know their way in the dark, by the shape of the air, within a month of their first solo flight. There were one or two possible crags within that area, but none of them were ideal. Moreover two Eyries so close together would be short of hunting grounds.

Five Eyries lay to the right of Onetree, and one to the left. Three of the Flyers had already announced the intention of traveling to the left.

"And you?" said the Mother of Mothers.

"Even Nyc Livelong wouldn't choose to fly past all five Eyries before he could start," said one of the other Flyers.

"No," said Nyc cheerfully, "but I shall turn right all the same."

"What . . . Where. . . ?"

"Up and over," said Nyc.

There was a brief silence.

"Up?" said someone incredulously. "You mean—?" He gestured at the high wall of rock that rose above the Cave mouths. Behind it rose another, high enough to dwarf it completely.

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

"*Over?*" exclaimed another Flyer. "The air's too thin!"

"Our Firstmothers came that way," Nyc said.

There was silence again for some heartbeats.

"I never heard that," said the first speaker suspiciously. "Did the Ologist tell you so?"

"Not in those words. He told me that in the Eyrie where the Hornless One set them the morning sun shone into the mouth of the Caves. Whenever he told that story he said the same."

The hearers looked at one another.

"Yes," said the Mother of Mothers slowly. "I heard him say it many times. There is no crag on this side of the mountains where it would be true. I thought—he was old, very old—I thought it was just a mistake."

"So did I," said Nyc ruefully. "Then one day after he died, I remembered. He liked to tell you something and leave you to find the meaning."

"Tiresome habit," said the third Flyer. "We are poorer without him," he added hurriedly. "All the same—"

"And just because of that—" said the first Flyer incredulously.

"Just because of that, three seasons ago, I flew to Waterbeard, to see what they might know."

"I suppose that would be the place to ask," said the Mother of Mothers thoughtfully. "That was where our Firstmothers settled when they escaped from the Hornless One. But I never heard that there was an Ologist at Waterbeard, or anybody like him."

"No, but they are great storytellers. They have many tales of that escape. One says—it is not the only way they tell it—that our Firstmothers came to Waterbeard by way of a great valley, winding among the roots of the mountains."

"Where did they come *from*, though?" said the first Flyer.

"The story does not say. The folk at Waterbeard say there is no valley like it within two days' flight."

"Well, then!"

"The folk at Waterbeard," said Nyc deliberately, "are wrong. The mouth of the valley is choked with rocks where the cliffs have fallen—you remember the Ologist spoke of a time when the mountain shook, in the days of our mothers' mothers' mothers? Perhaps it happened then. The valley is blocked for half an hour's flight. Beyond that it is clear."

"You learned this, I suppose," said the Mother of Mothers coldly, "when you returned two days late, with a tale of having flown too far over the plain to recognize the shape of the air."

Nyc made no attempt to deny it.

"But even if you found a valley," said the second Flyer, "it may not go all the way to the other side. You may find yourself up against the high mountains, where the air is too thin to carry you."

"Then I shall come back," said Nyc. "But if our Firstmothers traveled by it it must go all the way."

"You are arguing in circles," said the first Flyer crossly. "Our Firstmothers were great flyers, no doubt; but what about the younglings? How did *they* come?"

Nyc was momentarily silenced. "That," said the Mother of Mothers

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

unexpectedly, "would be a question even if we lived from the first on this side of the mountains. To escape the Hornless One our Firstmothers must have flown for hours, not once but at every move. It is impossible that they could have carried younglings with them."

"But—" said the second Flyer.

"It is also unthinkable that they should have left them behind. I considered this," continued the Mother of Mothers, "when I was planning how we must move ourselves, when the Eyrie is split. There have been three generations since Sundark split from Crowswing, and I have heard no tales of that splitting. But it seems plain that only Flyers can go."

"Onetree will be crippled!" said the third Flyer.

"No. The new Eyrie must start small, and grow orbit by orbit as the Fledglings mature; but Xs who are to go must not mate in the orbit before. There will be plenty of work in the first orbit of the new Eyrie without the need to set up a Kindercave."

The four Ys considered this in silence.

"All true," said Nyc at last, "but—"

"As for the journeys of the Firstmothers, it seems plain to me that there *were* no younglings at the time they escaped."

The Ys gazed at her in astonishment.

"We must not forget the Ologist's teachings, now that he is gone," said the Mother of Mothers severely. "For many generations a mating season has been declared in every orbit, but—

"Yes!" exclaimed Nyc. "He claimed that the birth-lists from Waterbeard in the early times show that the Firstmothers held a mating season only once in four orbits, so that when pointlings were born there were always Fledglings to help take care of them."

"And the Xs who gave birth to them were free to hunt and dig roots and carry water, along with the Ys," agreed the Mother of Mothers. "Then, after three generations, when there were enough workers and some to spare, they began to hold a mating season every year; and by the next generation Waterbeard Eyrie was large enough to split. . . . I cannot judge whether or not the Firstmothers were created on the other side of the mountains; but soon all the Eyries will need to split. If this hidden valley of Nyc Livelong's leads to crags and caves that we do not yet know, it will be well worth the journey."

The pass lay in shadow except for an hour on either side of noon. Here and there sudden gusts blew down from the heights above him; by midafternoon the thermals set up in the brief sun-time had faded out. Flying was all work, now. Every couple of hours Nyc needed to land on one of the narrow ledges and rest; a thousand heart-beats during which he was making no progress towards getting *out* of this place.

He wanted to be finished with it, to an extent that startled him. The steeply sloping sides squeezed the shape of the air. It was a *wrong* place to be flying in.

If the Firstmothers came through here, he thought, without knowing what lay at the far end, they must have been really desperate. The Hornless One must have been as terrible as the stories

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

CONTACT

Cultures of the Imagination (COTI)

You are invited to support an exciting learning project designed to teach worldbuilding and culture creation. During the past seven years, CONTACT simulations by top writers, scientists, artists and educators have proven the ability of "COTI" to promote interdisciplinary understanding.

Now, through "COTI jr," CONTACT brings science fiction literature to young people through an intermediate school curriculum based on CONTACT exercises. The "COTI jr" pilot project has been given seed funding by the Smithsonian Institution to help children create their own CONTACT and bring alternative futures to life in their classrooms.

Your $15 contribution to CONTACT will help underwrite educational projects like "COTI jr." It will also bring you our newsletter and keep you in touch with the annual CONTACT conference.

Yes!
I want to make
CONTACT

☐ I have enclosed $15 for 4 issues of the Newsletter
☐ I am also sending a tax-deductible contribution of $ _____
☐ I can't contribute right now. I have enclosed a self-addressed envelope (1 oz.), please send more information on CONTACT.

Name_____

Address_____

City_____State____Zip_____

Mail this completed coupon and your check payable to CONTACT:
Greg Barr, CONTACT; 1412 Potomac Ave. SE; Washington DC 20003.

CONTACT: Cultures of the Imagination (R) is a California non-profit educational and scientific corporation organized under IRS Code 501(c) (3)

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

said, if facing him was worse than flying endlessly through this constant compression and with no idea when, if ever, they would reach plain air again.

Nyc was not precisely afraid. Fear had no survival value for a flying hunter; the dangers he faced called for quick and decisive action, not terrified immobility. Foresight, on the other hand, and caution, were essential parts of his equipment. A flyer who failed to see the signs of an impending storm, a hunter who dropped his prey without noticing whether the spot was suitable for a rapid takeoff if the butchering got interrupted by other predators, was not likely to last even one mating season. But not even the most experienced Flyer could see round a blind corner.

He had estimated that to fly through the canyon, from the mountains he knew to the range dimly visible beyond, would take about six hours. In fact it had taken a little less. Half an hour later he had emerged from the shadow of those peaks, swept round a great bend, and found that the pass went on, and on; at least as far as the other range he could now see ahead of him, unknown flying-hours away.

By this time he had almost doubled the distance flown, and the new range was still a long way ahead.

Nyc had, he reckoned, about three hours of daylight left. He had been flying more than eleven hours continuously, except for a couple of brief halts; he had gone through fatigue into his second wind, and was now weary again. . . . He flew on, relentlessly, economically, making full use of any lift he could get from the occasional breeze to save his wing-muscles.

When the Foremothers came this way, no doubt one or more Flyers had scouted the pass in advance and picked out places to break the journey. Which was least attractive: to fly to exhaustion, or to deliberately settle down to spend a night between the roots of the mountains?

He flew on.

The thin plume of a waterfall cut the gloom ahead. There was a small ledge just wide enough for his hooves. He detached the nutshell cup that hung from his belt—the only extra weight he was carrying, apart from his cutting-iron—and drank one cupful, slowly, enough to relieve thirst without seriously increasing weight, then he rehung the cup and flew on.

Half an hour later he saw a mountain goat with a young kid. He ignored them. Time to remember hunger when he came to the end of this place.

The lower reaches of the pass grew dark, and Nyc used energy he could ill spare in rising to the level of twilight. Presently that, too, faded.

It was time and past time to find a ledge on which he could pass the night. . . . Nyc flew on. The shape of the air made a kind of trough; he kept to the midline. Every few seconds he uttered a brief shrill cry and listened for echoes. Without intending it, he had hypnotized himself into a state where going on took much less effort than finding a place to stop.

He rounded a vast curve, one of many, and the air lay flat. It flowed without obstruction to the farthest horizon of all his senses. Somewhere not

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

very far ahead of him the canyon came to an end.

Nyc flew into a breeze and out again, and then the moon climbed slowly over the horizon and he saw, below him, the tops of trees.

For some minutes he simply flew on; it took an effort to start looking for a place to sleep. It must be high for an easy takeoff. He banked slowly around until the black bulk of the tableland lay to his left. It would be easier to pick out a suitable ledge when the moon was higher. Meanwhile he relaxed, gliding on gentle thermals fed by the stored warmth of the trees. . . .

Nyc had no warning. The shape of the air suddenly twisted so that he was sliding irresistibly down the side of a great funnel. He tried to fly up, or out, or away; but every direction became downwards and every movement a sickening tumble out of the known and reasonable air into—

Just as suddenly, the funnel vanished. Once again the air around him was flat and unobstructed—except downwards. There, he had less than half a wing-length—two bodyheights at most—no room at all to maneuver.

He cupped his wings for a moment; snatched them in as his hooves rang sharply on whatever was beneath; and pitched forward on to it with a resounding thump.

For a moment his mind echoed with the noise. Then, as it cleared, he became aware of another sound. It had been there, faintly, even before he fell into the vanishing distortion of the air; a distant growling, which was now a roar. The source came rapidly closer until it was right overhead. A wind ruffled his fleece and a moment later turned into a down-draught strong enough to flatten him against the surface beneath.

The pressure was fierce, but brief. When it let up he discovered that he was lying on something smooth and rounded, like a great boulder, but—the electrical pulses through which, in part, he sensed the shape of the air informed him—it was hollow. The air within was barely the length of his forearm away. As for the air outside, it deepened on a smooth, steep curve that ended in flatness about a wing-span below.

Something like an enormous hollow tree trunk, with no branches, the bark impossibly smooth and hard. Nyc was lying head-down, partway around the curve of it. He tried to shift round, and began to slide.

He slapped his palms hard against the surface and managed a halt, at the cost of incipient blisters and a certain amount of noise. He was now looking almost directly downwards at an expanse of level ground. The shadow of whatever he was lying on fell across it, ending a wing-span away in an impossibly straight line.

Everything in Nyc's present situation was incomprehensible and much of it perilous; but that weirdly unnatural boundary between darkness and moonlight distracted him for several heartbeats. Then the roar became deafening. A round-edged shadow slid out of the straight one on to the moonlit ground, and something dropped out of the sky and sat down on it.

A heartbeat later there was a thudding below and a sheet of brightness, sharp-edged as the darkness, shot out from

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

under Nyc's resting place. Shadows moved on to it on impossibly long legs, that shrank as they hurried down its length. It was not until a heart beat later that Nyc noticed the moving foreshortened blobs casting them.

The roar diminished; stopped. The moving objects—creatures—had reached the fallen thing. Light shot out; most of it lay on the ground, but some fell on the creatures and what they were carrying away. Bunches of bananas. Baskets of edible roots. The carcass of an antelope—a kind which Flyers never hunted because the joints were too large to lift.

Nyc remembered abruptly that he had not eaten for sixteen hours, during which he had flown further and expended more energy than ever in his life. Now that he had been reminded of it his whole body ached for food.

Should he launch from this point, the height was just about adequate in this thick air, glide over one of the fruit-bearers, snatch—?

Not only was there a high risk of crashing, but he would not have the leverage to wrench a hand of bananas from the stem.

Nyc swallowed saliva, and averted his eyes. Once he had a chance to take off unobserved he could find some fruit in the treetops, and perhaps a sleeping bird. Meanwhile—

Shori herda nimpakt onner hull landen minus thirtasecsor so. Shoryu didden dropeni thing—

Onia lunierd jetty sunovertha hull. Mitre binner brarnsh. Usienny dense?

One of the creatures tilted its head back. Nyc looked down at a face that could have belonged to a middle-aged Flyer, except for one thing; under the short tight curls the broad expanse of forehead was unbroken by anything but wrinkles.

THE HORNLESS ONE!

Nyc's eyes snapped shut. He heard a grunt below him.

Siennithing?

Haddernigh dearigh—Naw.

Footsteps passed into the hollowness below.

Nyc stayed where he was until a thudding vibration heralded the disappearance of the light. Presently he was once again able to make sense of the shape of the air around, and found it undisturbed by moving things. His fingers, exploring cautiously, found a crack of some sort—shallow, but sufficient to give his nails some purchase. With that, and the friction of palms and knees, he managed to get turned around and made his way up to the highest part of the —tree trunk? Boulder? Hill—? Once there he rose cautiously, balancing; got his hooves under him; ran recklessly for a dozen steps along the ringing surface, and hurled himself into the air.

For a moment he thought the takeoff was going to be a failure; then a strong and quite unexpected updraft took hold of him. Hurled upwards in warm air he heard a creaking, followed by cries and the sound of running feet. Shafts of light sprang up; but he was already beyond their reach.

The updraft proved to be very localized, but it had taken him high enough to glide without effort to where the trees began.

Nyc became aware that he was dan-

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

gerously close to exhaustion; if he did not find a landing place in the next hundred heartbeats he was going to lose control and fall out of the sky. He cast round for a treetop thick enough to take the shock; and sensed something broad, flat, and solider than the densest assemblage of twigs, barely three wingspans away.

A hallucination, like the one that had nearly trapped him earlier? But he had to get down, *now*, or fall. Nyc banked, shed height, and cupped his wings to land.

No hallucination. It knocked the breath out of him, in fact, and for half a hundred heartbeats he could do nothing but cling to it with heaving lungs, while a little whirlwind sprang up inside his head. It settled, presently, and he took stock of his surroundings.

He had come to ground on a thick layer of something soft and rustling. Banana leaves, he decided presently. In Crowswing Eyrie they used them for bedding. Could this be something's bed? Hardly; it sloped. Moreover the leaves were packed hard and fastened down very firmly.

Nyc felt around. He was lying quite close to the upper edge of the slope. Below it, two body-heights down, the shape of the air was cut by another surface—flat. Once again he was aware of hollowness directly below him but this time it was open. In fact this was some sort of made-cave, like the ones some Eyries put up for the visiting Ys at mating time. But solider.

How much solider, Nyc discovered when he had dropped from the thatched roof to the platform below. This was at least a finger-joint thick, and perfectly flat. How that had been achieved he had no time to speculate; because the air within the cavity smelled strongly of bananas, and his hunger had revived and was screaming for them. He found them, presently, hanging from the roof; beyond his unaided reach, but a frantic search produced something movable, strong enough to stand on, and high enough to let him reach.

The first banana shot from its skin and went down his throat too fast to taste it; and the next, and the one after that. With the fourth, he became aware that they were gluey with over-ripeness. The fifth one almost stuck in his throat.

There was water somewhere; he could smell it. Questing, he came across a tall smooth-sided—something. The top was closed but he could smell the water inside. Feeling around, he came across something that stuck out near the bottom. Water suddenly gushed out of it on to his feet.

Nyc dropped under it and opened his mouth. . . . After a couple of choking fits, he remembered the cup at his belt. He drank half a dozen cupfuls, then the flow of water stopped. Now his body could afford to give full reign to fatigue. There was a good deal of water on the floor, but he crawled to a dry patch, curled up on his side, and was fast asleep.

Nyc was woken by sunlight just in front of his nose. He blinked, groaned, and levered himself up on to one arm. He made a half-hearted attempt to rise further; then the nature of his surroundings struck through his eyes to his brain.

Everything was in straight lines. Every surface was exactly, perfectly flat, ex-

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

cept for a few that were exactly, perfectly rounded. The floor he lay on was composed of long flat straight-sided pieces of— He looked more closely at it, patted it, kicked it with the edge of his hoof and succeeded in dislodging a splinter. So far as he could make out, it was wood.

But wood was rounded. You could make a flat place on a branch, with a cutting iron, but to do *this*—

Flat places. Straight lines—

The Hornless One!

Last night he had *seen* him, in the flesh. And, he realized suddenly, the flying iron in which the Hornless One traveled, faster than any Flyer. And that thing he had landed on, enormous, hollow, many-chambered; was that the great Flying Iron that went from one world to another?

It was an awe-inspiring idea that the legendary Maker, Teacher and Destroyer from the dawn of history was again at large on the planet; but what Nyc felt most was curiosity. Was this in fact the real, the original Hornless One? The other creatures; were they Hornless Ones also?

No creature could exist entirely alone; there must have been an X to bear it, and a Y to quicken her. The story itself showed that there were other Hornless Ones, or how could he have stolen their eggs?

But what were they doing here?

Forgetting his stiffness, Nyc leaped to his feet, staggered, and caught hold of a nearby—object. The one, in fact, which he had climbed on to reach the bananas. By daylight it seemed rather elaborate for the job; but it gave him a useful start on getting back on to the roof.

From the top of the tree beside the made-cave, Nyc gazed out in frustration over the undulating canopy. Fifty or sixty treetops away there might be something visible, something huge and grey and dully glinting, or he might be forcing his eyes too far.

He extracted one of the bananas stored between his wings and his shoulders and ate it without enjoyment. To get a useful view of the place where he had seen the Hornless Ones, he must either clamber laboriously from one treetop to another, or fly. If he flew, the Hornless Ones might see him; or he might fall again into the weird trap, like a still whirlwind, that had almost captured him—

Once again the shape of the air tilted suddenly around him. Nyc clutched at the nearest twigs. He found after a moment that he was still standing firmly enough, the dew-claws behind his hooves helping him to grip the branch.

A black dot appeared in the sky. It grew rapidly, not only to his eyes but to his other senses. He began to hear, distantly, a roaring that he recognized.

The thing dipped in the air and swayed around, showing that it had a tail—straight, rigid, with a transparent thing above the end. Another, larger, over the body. Things like the circles that came on still water when you dropped a pebble in. . . . Nyc had spent one whole afternoon by the tarn on the headland above Onetree Eyrie, trying to catch one of the bright rings and bring it home. Had the Hornless One, leg-

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

THE PAST, THE PRESENT, THE FUTURE, THE UNKNOWN.

SUBSCRIBE NOW AND SAVE 34% OFF THE COVER PRICE

CALL TOLL-FREE 1-800-333-4561

YES SEND ME

☐ 18 issues for only $29.50

[ ] Please send me 12 issues for only $19.97

SCIENCE FICTION
analog
SCIENCE FACT

Mail to: P.O. Box 7060, Red Oak, Iowa 51591

Name_____

Address_____

City_____

State_____ Zip_____

Please allow 6-8 weeks for delivery of first issue. *Outside US & Poss. 12 for $22.97, 18 for $33.97.*
All foreign orders must be paid in advance in U.S. currency.

HJSC-2

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

endary doer of the impossible, actually managed it?

Presently the thing dropped out of sight. A couple of minutes later the skewed air returned to its proper shape.

Nyc fished out another banana and ate it thoughtfully. It would be safer to *walk* to the clearing, then climb a tree at the edge of it. There was even a trail running right below the made-cave, a broad one, made presumably by the Hornless Ones. No danger of running into them—he could hear their footsteps a hundred wing-spans away.

However, it would take even less effort to stay where he was and see if a Hornless One would come. Obviously the made-cave belonged to them, though what they used it for mystified him. He had explored it briefly, finding various small irons of unguessable function; also, in the long wall, what looked like an oblong hole, filled with something hard and transparent, like stiffened water.

The Hornless Ones were strange and clever, just as the tales said. They must need to be. Under the made-cave was a thing built from two stout saplings, with sticks lashed across at intervals. With a made-tree like that Fledglings could help to carry down loads of roots from the plateau above the Eyrie, instead of Flyers straining their wings against the weight. But if Hornless Ones needed it to climb less than a wingspan, there was nothing to fear from them among trees.

Time passed and grew boring. Nyc decided to take another look at the irons in the made-cave. He was hardly a wing-length above the roof when he heard the heavy footsteps of Hornless Ones on the trail below.

Nyc froze. Presently a deep voice uttered a string of meaningless sounds, like those he had overheard the night before.

Yullbi kehrfle, wontu, lindi. Ff farland fayndsis apper raytus mestup eel blowis top.

A momentary shiver ran over Nyc's skin. The Hornless One had given flight to his Foremothers and taught them all they knew. To hear it—or its descendants—mouthing gibberish, like monkeys, disquieted him.

A second voice spoke, at a higher pitch.

Ime notter bay be, unkull rod.

Nyc inched one eye cautiously from behind the stout trunk and saw a Hornless One step on to the platform. It uttered a cry.

Unkull rod, theresbiner monkey!

Ime coming! Hole don!

Nyc had never heard of *language;* all he knew was speech. Frequent visiting kept it more or less uniform from one Eyrie to another. Strange accents, let alone dialects, were right outside his experience.

He was beginning to suspect, however, that these noises had meaning to the Hornless Ones if not to him. Rhythm, the *shape* was like speech. Twice he had thought he recognized a real word.

The second Hornless One reached the made-cave. This one was also Hairless, the top of its head polished and shiny; whereas the first one's head carried something like a mat of dark thatch.

My word, wottermess! Hasit damidged anyerthi kamerers, lindi?

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

Nyc had no idea what had been said, but it was a question; he felt sure of that.

I doent think so, unkulrod.

Thinkyud betta come back with me?

Korsnot, its gone. Ime notter frayder monkeys.

Dam things gotter tapopen, the waters all gone.

Ime not thirsty.

Well, orlrite, Yusyer comm if anything happens, Siya soon.

It was maddening. Every so often a word would emerge—sometimes two or three in a string—then all would be babble again. What was "frayder" or "tapopen"? When the Hornless One taught speech to the foremothers, why was it not that of his own kind?

The hairless Hornless One stumped down the made-tree. The other one threw out the banana skins Nyc had left the night before and fidgetted around the made-cave for a while. Then the noise of its movements ceased. There was silence for several hundred heartbeats then it suddenly began a strange and rather noisy talking—to what?

Cautiously, and very slowly, Nyc came down a couple of branches. Now if he inched a little further along the one he was standing on, and leaned sideways a little—

The branch stood the strain until he had one eye just beyond the wall of the made-cave. Then it broke.

Nyc landed on his hooves, but they skidded from under him and he fell heavily on hands and knees at the feet of the Hornless One. He thrust himself hurriedly up and found it bending over him.

It loomed at least a foot taller than Nyc, and its body was thicker. Except for its head and hands it was completely covered in something brightly colored that was neither skin, leaves, nor feathers. Its eyes were wide open, and blue.

Eyeing it warily, Nyc got to his feet, It was standing, or stooping, between him and the top of the made-tree. They stared at one another in a silence that was broken by a shout from the ground.

"Lindy! Timeter go!"

The Hornless One jumped. Its mouth opened, but no sound came out.

"You all right up there? Shall I come up?"

"No!" The Hornless One rushed to the top of the made-tree and started to descend.

"Now wotervyu been doing up there, Lindy?"

"Nothing! I put things tidy where the monkeys threw them around. I sang a bit. That's all."

"Good."

Nyc listened to their footsteps thudding away. Then he rotated his left wing out from the shoulder, opened it a little, and ducked his head to see.

There was a bloody scratch on the wing-skin between the second and third fingers, where the splintered branch had caught it. For the length of half a hand-finger it was torn right through.

Dried banana leaves did not make a good mattress. The flakes that broke off under Nyc's weight were sharp and by the end of the first hour had worked their way through his fleece to the skin. At Crowswing, he remembered, they covered the stuff with antelope skins before they lay on it. But the roof of the made-cave was the only place where he

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

THIS YEAR ENTER ANOTHER DIMENSION.

ISAAC ASIMOV'S SCIENCE FICTION

SUBSCRIBE NOW AND SAVE 34% OFF THE COVER PRICE

CALL TOLL-FREE

1-800-333-4108

☐ Please send me 18 issues of ISAAC ASIMOV'S SCIENCE FICTION MAGAZINE for only $29.50 —I save 34% off the newsstand price.

☐ Please send me 12 issues for only $19.97.

Mail to: **Isaac Asimov's**

PO. Box 7057. Red Oak. Iowa 51591

Name _____

Address _____

City _____

State _____ Zip _____

☐ Payment Enclosed ☐ Bill Me

☐ Charge (Circle one) MasterCard VISA

Card# _____

Exp. Date _____

Signature _____

Outside US & Poss. 12 for $22.97, 18 for $33.97.

(CASH WITH ORDER US FUNDS). PLEASE ALLOW 6-8 WEEKS FOR DELIVERY OF YOUR FIRST ISSUE.

MJSG-7

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

could keep his wing spread. If he closed it for more than a few hundred heartbeats before the scab hardened, the wing-skin would stick to itself and heal puckered; his wings would never be in perfect balance again.

At least he had something to think about.

Hornless Ones—in particular the Hornless One he had met face to face in the made-cave below.

Nyc had never given very much thought to the reasons why people behaved as they did. It was only rarely that anybody in Onetree Eyrie did anything unusual enough to require thinking about. He had never really wondered, either, what reasons the Hornless One might have had for its actions, strange as they were; presumably it had been behaving as it was its nature to do.

This new Hornless One seemed to have an altogether different nature. . . .

But then, people in the Eyrie had different natures, too.

He thought about this. It was not easy, because (1) there were 187 adults in Onetree Eyrie alone, all of them different in one way or another and (2) if there were words for the differences, he did not know them. Presently, however, it became clear to him that there was an important difference between the many who went on from day to day, more or less happily following custom or habit or necessity, and the few who decided what was needed and saw to it that it got done.

There were not more than a hand's count of them in any Eyrie. The Mother of Mothers, of course; and someone who saw to it that foods were collected and stored, each in their season; and someone who knew about healing; and someone wise in the ways of the herds who knew where to look for game when the season of plenty was past. Some were X and some Y, some came to it when their flying days were nearly over and some were trained by their predecessor practically from a Fledgling; but they were alike in one thing: the Eyries needed them to survive.

Then there were a few—maybe a hand's count in all the Eyries put together—who were like nobody but themselves. The Ologist, for one. The X at Sundark who tasted plants—a tiny piece of each, but it was a wonder she was still alive, having discovered more than twenty poisonous ones, as well as three new potherbs, five purgatives, two that caused visions and one that gave peaceful and dreamless sleep. Then at Waterbeard there was one Y who could make you believe you saw and heard the events he was describing, as long as he was speaking; though the tale, considered afterwards, might be wholly impossible.

What they did came in useful sometimes, but that was not why they did it. They would have gone on doing it even if the Mother of Mothers forbade it. That was their nature.

Obviously the Hornless One, the first and original Hornless One, belonged in the second group. The hairy Hornless One did not; in fact it reminded him of a Flyer at Red Rock Eyrie who had been caught by a sudden gust and had cracked his head against the cliff. When Nyc saw him he seemed unable to take care of himself and even Fledglings ordered him around. . . . Nyc could not imagine a normal inhabitant of any Eyrie en-

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

countering a strange Flyer, let alone a strange creature, and simply *going away*.

Strange, but lucky for Nyc Livelong. . . . He drifted into a doze.

The voices did not wake him until the owners were right underneath.

"Unkullrod, it's all *right,* you don't have to come up."

"Cooler needs filling. And suppose the monkeys have come back, eh?"

It did not strike Nyc immediately that the noises made by the Hornless Ones had now become words—often words he knew. He had discovered that he had slipped downwards on the roof until his hooves were dangling over the edge. He drew them up hurriedly, scrabbling for a purchase. After a moment they found a solid bar under the slippery thatch, and he could take the weight off his cramped hands.

"Got your comm, Lindy? If you see any of the big monkeys you use it straight off, right?"

"Yes, Unkullrod."

Feet went down the made-tree and he heard them plodding away.

Nyc found a higher bar under the thatch and drew his feet up on to it. Now he could raise his head high enough to see over the top of the roof.

He did so, and found himself staring down the slope into the eyes of the hairy Hornless One.

It was not tall enough for its head to reach the edge of the roof unaided; it must be standing on something. It stared at him solemnly.

"Are you hungry?" it said.

Nyc understood perfectly.

"Yes," he said fervently.

"Thought you must be. You ate all those bananas, and they weren't very nice. Here," said the Hornless One.

By stretching his arm as far as possible, while the Hornless One did the same, Nyc could just grasp the thing between two fingers.

Hornless Ones were very clever with water. Somehow they had managed to get the skin off, tan it, and make it into a bag. The bag had square corners, like most of their handiwork, and the thing inside was nearly square also. Nyc pulled it out.

Part of it was cold roast antelope. Nyc ate that in three bites. The rest . . . Did Hornless Ones make even roots grow square? He nibbled the edge cautiously. It tasted harmless, and his body was still complaining of energy stores not replaced. . . . He finished the lot.

When he looked up the Hornless One was staring at him again.

"My name's Lindy," it said. "Lindy Morrow. What's yours?"

Nyc hesitated, chiefly because he was not used to elisions; obviously any harm in the situation had been done already.

"Nyc Livelong," he said.

"That's nice. Do you? . . . Live long, I mean."

Nyc thought about it. "I have lived for eighteen orbits," he said.

The Hornless One pushed the hair back from its forehead and scowled thoughtfully. "That's . . . about forty-two standard years," it said finally. "Dr. Farland's forty-five. Unkullrod's older than that."

"Many Flyers live for thirty orbits or more," said Nyc, vaguely offended. "My name comes from the Firstmothers; fourteen had it before me. I was the

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

The Shape of Things to Come

As a reader of *Analog Science Fiction/Science Fact Magazine* you are keenly interested in the shape of things to come, our potential futures, and how science and technology will affect the spectrum of human experience.

Analog Science Fiction/Science Fact Magazine challenges its readers to speculate beyond the mundane and day-to-day. We want our readers to ponder, question and debate the impact scientific inquiry and discovery will have on the way humans live, relate to one another (as individuals and nations), conserve their environment, and express themselves intellectually and artistically.

The Shape of Things to Come

In a world of mundane credit cards, the "Far Travelers" MasterCard is the only credit card created exclusively for readers of science fiction.

The unique design identifies you as an individual committed to the exploration of human potential.

When you use the "Far Travelers" MasterCard, you will help ensure humanity's continued Far Travels into space because...

Every time you buy something with the "Far Travelers" MasterCard, *Analog Science Fiction/Science Fact Magazine* will contribute a percentage of the price to the National Space Society.

The National Space Society is the leading advocacy organization for space exploration. The Society seeks to generate public support for the space program through its education programs, and encourages space-related research by private industry.

The "Far Travelers" MasterCard is the only credit card that enables you to deepen humanity's commitment to the exploration of space.

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

The "Far Travelers" MasterCard
will serve you well in this world.

- There's no annual fee for one full year!*
- A competitive interest rate of prime plus 7.7%*
- 25 day interest-free grace period when your balance is paid in full each month.*
- Instant Cash at ATMs and bank locations throughout the world.
- $250,000 Travel Accident Insurance at no extra cost.
- Purchase Security protects virtually anything you buy with your credit card for 90 days, Extended Protection doubles manufacturer's warranty for up to one year.

First City MasterCard
Terms and Conditions

Annual Percentage Rate for Purchases	18.2%
Variable Rate Information	The Annual Percentage Rate may vary. The rate is determined by adding 7.7% to the Prime Rate listed in the "Money Section" of the *Wall Street Journal* published after the 15th of the month preceding the first day of the billing cycle.
Grace Period for Repayment of Balances for Purchases	You will have 25 days after the statement date to repay your outstanding balance in full before being charged a finance charge on new purchases.
Method of Computing the Balance for Purchases	Average Daily Balance (including new transactions) Method
Annual Fees	Membership Fee: $20.00 per year. Under this offer, the annual fee will be waived the first year. At the beginning of the second year, the annual fee will be billed to your account automatically.
Minimum Finance Charge	None
Transaction Fee For Purchases	None
Transaction Fee for Cash Advances: $1.50 **Late Payment Fee**: $15.00 **Over-the-Credit-Limit Fee**: $15.00	
The disclosures above are accurate as of the date of printing on 12/12/89. These terms are subject to change after this date. Call First City Bank-Sioux Falls, N.A. at 1-800-641-7878 for any changes in the terms disclosed.	

FIRSTCITY.

If you would like a "Far Travelers" application, please call (800) 641-7878.

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

first to be born after the fourteenth died."

"Why do you talk like that?" said the Hornless One.

"What do I talk like?" Nyc was beginning to get irritated.

"Like an actor in an old play. It sounds nice," it added placatingly.

"I talk as our people were taught to do. By the Hornless One."

"Who?"

"A creature of your kind. He came to this world and changed the eggs we were born from, so that we would be able to fly."

"Oh! You mean Quentin Morrow! He was my ever-so-many-greats Grandad. Why did you call him the Hornless One?"

"We have horns. He . . ." Nyc's voice trailed off as a thought occurred to him. "He taught speech to our foremothers, and gave them names. Perhaps he taught them to call him that."

"It's a funny sort of name. Did he make you have horns, too?"

"Yes."

"Do you like having them? And wings?"

"Of course I do."

"That's all right, then. Dr. Farland said if Quentin Morrow had really tried to carry out his designs the result could be a nonviable wreck, but you aren't, are you? I mean, you really can fly?"

Nyc understood the last sentence. "Of course!"

"I wish *I* could."

Lindy flinched suddenly. "Oh, gosh, I haven't taken that damn pill." It raised its left hand. There was a broad band around the wrist with a number of small irons on it; Lindy pressed one of them and something like a tiny egg slid out onto its hand. The Hornless One swallowed it.

"I have to take those twice a day to slow my metabolism down. Air on this world's got 27 percent ocksijen and it's a lot denser than at home, that's why Grandad Morrow thought people here could fly. . . . You don't have to hide now, everybody's gone to look for the place where Grandad Morrow made his camp. Old Farland thinks he may find people like you living close to it. Are they?"

"No," said Nyc firmly. He did not understand "camp"; but surely the Hornless Ones would not have crossed to the other side of the mountains.

Lindy giggled. "Sucks to him. Why don't you come down and sit with me?"

"My wing is torn and I have to keep it open until it is healed."

"Oh! Does it hurt?"

"No. Why does—Doktafarland—look for people like me?"

Lindy raised a hand and pulled thoughtfully at its hair.

"Well, it's kind of his job. See, he was writing a book about Quentin Morrow—"

"What is rytingabuk?" said Nyc.

Even after Lindy had fetched a "book" from the made-cave and explained what the strange broken lines, faintly reminiscent of those on birch-bark, were intended to do, Nyc was still confused.

"Look," said Lindy, "never mind the book. Dr. Farland wanted to find out all about Quentin Morrow because he's a creative geneticist and Quentin Morrow was one of the best ever. He made dozens and dozens of tailored spe-

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

cies, right when the terraformed worlds had been rediscovered and people were starting to colonize them. Our world, Deventer, wouldn't grow crops properly because of too much lead and copper and stuff in the soil. I mean the crops *grew* but they were poisonous, so they asked Quentin Morrow to help and he made a grass species that would suck all the heavy metals up into itself. And they still use it; every five years the fields are planted with it, then it's all dug up and burned, and they use the ashes to get the metals; the crops are all right to eat for four years after that and then they do it again."

Nyc understood perhaps one word in ten and could make very little of those. Possibly it would become clear later. He held his tongue.

Lindy rushed on: "So they didn't have money to pay him, so they gave him a lot of land instead. And he built a big Research Unit to work on more plants and animals, and when Quentin Morrow died it passed to his descendants, and Unkullrod and me are the last, so it's ours now. And Quentin Morrow didn't die on Deventer, it was on New Balmain. And Dr. Farland went there doing research and he found whole heaps of papers and notebooks and things in store, and bits of them had just crumbled away, but he read enough to find out that Quentin Morrow had highjacked a whole consignment of human embryos going to one of the colonies and taken them to an unregistered terraformed planet to try and make flying people."

Nyc, who had almost given up, jerked back to full attention. Here, suddenly, was something he understood.

"So he came to Unkullrod and asked him to fit out an expedition to the unregistered planet, because there's a spaceship belonging to the Institute, and he said there'd been a huge awful scandal when the embryos were hijacked and the wrong people got blamed and it all ought to be cleared up. And the descendants of Quentin Morrow's experimental subjects might still be lingering on here in—in misery, and we owed them something. So Unkullrod wasn't going to do it, but then one of the Syndicate gangs tried to kidnap me so he decided he would, and bring me too. And we've been here three weeks trying to find people like you and making a survey of planetary ecology or something so the journey isn't wasted in case we can't—"

There was a strange little sound. Lindy raised its wrist and stared at it. Then it did something with the other hand, and said "Lindy here."

A faint muttering invaded the air.

"Oh, Captain, Luke keeps thinking he's seen things—"

More muttering.

"No! No, I'm safe in the hide, I don't want—"

Mutter, mutter.

"Oh, all *right* then, but I think it's *silly*."

It raised its eyes to Nyc. "One of the crew thinks he's seen a leopard in the forest and the Captain says I've got to come back to the ship or he'll send a crewman to guard me. So I said I'd go."

"Leopards are dangerous," said Nyc.

"Yes, but Unkullrod says no leopard would come within a mile of the ship, with all the noises there. *You* aren't

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

afraid of it, are you? But I suppose if one came you could always fly away."

A strange whining sound had begun and was growing. Lindy dropped out of sight and he heard its footsteps on the made-tree. It said something which Nyc could not make out—the whining was now quite loud. Presently the sound moved away.

Nyc lay on the prickly mattress of the thatch and tried to make sense of what he had learned.

Grandad was a new word to him, but it was fairly clear that it meant "fore-mother." The Flying Iron was called *Ship* and was something like a mobile Eyrie, but very strangely organized. Dissension was unheard of within the Eyries, or between them; but it sounded to Nyc as though Unkullrod and the one called Doktafarland behaved like the leaders of two warring bands of monkeys.

Then *Lindy* had deliberately concealed his existence from other members of the Ship, including Unkullrod who seemed to be one of the Mothers, if not the Mother of Mothers. Why?

There was nothing like this behavior in any of the Ologist's histories; except perhaps the story of the Spoiled Flyers who had helped the first Nyc Livelong to escape from the Flying Iron. Had *Lindy* been Spoiled somehow?—hurt or mistreated by Unkullrod or one of the other Hornless Ones—?

Doktafarland believed that the Hornless One had made only Spoiled Flyers. Lindy had been glad to learn that it was untrue. But *why* had the Hornless One made Flyers and what did its descendants want with them now? The sun shone straight down through the leaves. The thatch was not bad to lie on when one got used to it. . . . Once more Nyc fell asleep.

Next day Nyc was inspecting the damaged wing—probably usable, in a pinch—when Lindy returned. Its arrival was heralded by the whining noise. He shuffled to the end of the roof and tried to squint round it, but could not get a sight of the cause.

When Lindy's face appeared at the roof's edge it was beaded with sweat.

"I brought some more food," it said.

It tugged a string over its head. and handed up a large bag. Inside were half a roasted duck, six boiled yams, and several kinds of fruit.

"If I asked for a snack they wouldn't give me enough, so I had to steal it. Then I had to wear a jacket to hide it under, and say I felt cold, and Unkullrod thought I must have a fever coming."

Nyc understood only a little of this, but he recognized the note of expectation and expressed his genuine gratitude.

Lindy watched him in silence for about a hundred heartbeats.

"Was Great-grandad Morrow a good person?" it said.

Nyc could remember asking the Ologist much the same question.

"It is two hundred and fifty orbits since he went away. Nobody is alive who knew him. There is only the story."

"Tell it to me?"

"When I have finished eating. Do you want some?"

Lindy accepted a drumstick and sat nibbling it until Nyc dropped the last of

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

WEAR THE FUTURE

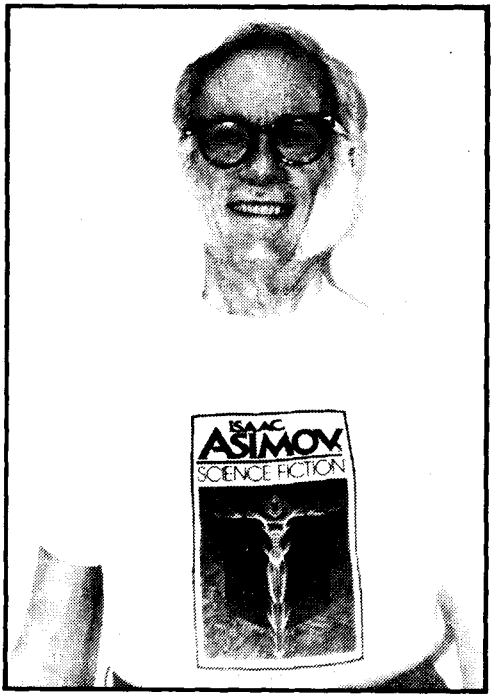
Isaac Asimov's T-Shirts are light years beyond the ordinary!

THE IAsfm T-Shirt features the color artwork of illustrator Joe Burleson. The extraterrestrial image is printed on heavyweight, high-quality fabric. Satisfaction guaranteed or your money back.

ONLY $7.95

Plus $2.00 postage and handling.
Please specify size and quantity.
Allow 6 to 8 weeks for delivery.

IAsfm T-shirt
Davis Publications, Inc.
380 Lexington Avenue
New York, NY 10017



Please send me ____ IAsfm t-shirts
Please specify size __ S __ M __ L __ XL

Name _____
[PLEASE PRINT]

Address _____

City _____

State _____ Zip _____

Please enclose personal check or money order. No COD's please. New York residents please add sales tax.

Send to: IAsfm T-shirt
Davis Publications, Inc.
380 Lexington Avenue
New York, NY 10017

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

the duck bones over the edge of the roof and licked his handfingers clean.

"*Now* will you tell me?" it said.

He told the story of the Hornless One, as the Ologist had told it to him. Lindy listened round-eyed until he came to the killing of the Spoiled Flyer. Its face suddenly crumpled.

"That isn't true! He can't have done that!"

"The story says he did."

"Then it's a beastly story and I don't want to hear any more."

Lindy ducked under the roof and disappeared.

Nyc was sorry to have upset it. He was also worried. He rose to a crouch and folded the damaged wing, moving to a position where he could climb easily into the branches.

After several hundred heartbeats Lindy returned.

"Nyc, I—Nyc?"

"Here."

"Oh. I thought you'd flown away. Is your wing better now?"

"Yes."

"Will you finish the story?"

Nyc hesitated. "If you wish me to."

"I want to know the end of it. Why did you get up? Are you going away?"

"I will tell you the end of the story. Then I must go." He did not intend to fly back to the Eyrie until he had found answers to many more questions, but a prickling in his skin suggested that it was time to find some other resting-place.

He finished the tale as the Ologist had told it, saying nothing about the journey to the other side of the mountains.

At the end Lindy heaved a long sigh.

"Are your people still living there?"

"Some. There are seven Eyries now. Soon they will all be full and it will be time to find new crags again."

"How many of your people are there?"

"More than two thousand," said Nyc proudly.

"And are they all happy being—what they are?"

That was a puzzle. Younglings—Fledglings especially — were unhappy from time to time, and even some Flyers, when they lost a kill to other predators, or felt that they were getting old. But—

"We are all happy to be Flyers," he said firmly. "None of us would want to live without wings."

A shiver ran over his skin. The words had escaped before he thought. He rose abruptly to his feet, balancing on the ridge of the roof.

"Now I must go," he said. "I thank you for the food, and for . . ." Speech had no word for friendship; it had never been needed. A Flyer who felt specially close to another showed it by grooming them, but Lindy had no fleece. He ended, "For talking to me—"

There was a sound somewhere below—a small sound, but somehow ominous. Lindy turned its head and nearly fell off whatever it was standing on. It clutched the edge of the roof and screamed, "Run!"

Nyc leaped for the nearest branch. As his fingers touched it all his muscles failed him. Momentum brought his head up among the leaves and his hands brushed the bark, without closing; then he fell back on to the roof and slithered helplessly down the thatch.

Lindy had disappeared, though he

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

could hear it yelling. Another face appeared at the roofedge. Large hands slowed the sliding and lifted him effortlessly down into large arms ready to receive him. Two different brands of sweat invaded his nose. He was dumped into a net like the ones used to carry game back from the hunt, lowered on a rope and deposited, quite gently, on the ground.

Lindy was shouting monotonously "Let him go! Let him go! Let him go!"

"Now, Lindy. He isn't hurt and we aren't going to hurt him." The voice was not Unkullrod's. There was a yapping note to it, like a jackal's.

"You stunned him and that's bloody horrible afterwards. Luke got hit once, he told me. And you've got no right to do it, he wasn't hurting anyone."

There was a sound that could have been a kick landing on an ankle, and a half-stifled yelp of pain. Lindy's face was suddenly above him.

"Nyc, I'm *sorry!* I didn't know they were there, and I'll tell Unkullrod and he'll make them let you go."

"Don't promise what you can't perform, Lindy. Your uncle is as eager as I am to make contact with your ancestor's alate humanoids. I imagine he'll want to know why you chose not to inform him about your encounter with this specimen. Also where you learned such unladylike behavior."

Nyc became aware of a distant thrumming with a faint whine superimposed upon it. His senses were not affected by whatever had disabled him. He could move his eyeballs, also his jaws, lips, and tongue; but nothing else. He hated the idea of being helpless before the owner of the yapping voice. But at least he would be able to bite, if it gave him the chance.

"You're a horrible person, Dr. Farland, and I'll kick your other shin if you touch me again."

The whine was getting louder. Suddenly one of the Hornless Ones—the one who had not yet spoken—heard it, too.

"Floater's coming, Dr. Farland. Think it may be Mr. Morrow?"

"Oh, damn."

Nyc rolled his eyes sideways as far as he could. On the edge of his vision something slid into view. A long, hard-looking, greyish-brown . . . something, moving quite slowly, without any legs . . . a creeping-iron? The hairless Hornless One was sitting inside.

Lindy rushed towards it.

"Unkullrod, that beastly Farland shot my friend Nyc with a stunner, and they tied him up in a net. Make them let him go!"

The yapping voice broke in.

"Your niece is hysterical, Morrow. I finally located a specimen of *Homo alatus* and was forced to have it stunned. It was about to escape."

"Found one of old Morrow's flying men? How d'you happen to do that?"

"Unkullrod, it was me who found him, and he's *nice*. Old Farland didn't have any *right* to use a stunner on him!"

Heavy footsteps shook the ground. Unkullrod's voice sounded from almost overhead.

"Difference of opinion here. Who did find him first?"

Farland gave a slight cough.

"Oh, Lindy, certainly. She came across him yesterday, but elected to conceal the fact."

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

"How do you know, then?"

"My dear Morrow, you surely remember that the hide is fitted with a voice-activated recorder-transmitter. I remember you complaining about the cost. Lindy had quite a conversation with the alate yesterday. I found the record on the receiver in my laboratory. I judged that if I let her talk to him again he might let slip something useful, and in fact he did—I now have a record of the alates' folk-memory of Quentin Morrow which might have been quite difficult to elicit directly. He taught them to call him—"

"Just a minute, Farland. My niece was meeting this—alate—all by herself? You knew about it twenty-four hours ago? Why the hell didn't you let me know?"

The cords of the net began to drag on the top of Nyc's head. He felt himself sliding slowly and jerkily over hard-packed earth. Staring down past his own jaw he saw Lindy crawling slowly backwards.

The other Hornless Ones were beginning to shout at one another—the third one had got drawn in somehow and judging by its tone was defending itself. Lindy suddenly rose to a crouch, heaved Nyc into its—no, *her*—arms, took a couple of rapid steps and deposited him in something that bounced slightly and smelled very strange. She got in beside him and began to fiddle with various irons protruding from a flat surface in front. There was a whining noise which Nyc recognized, a sudden jerk, and the trees at the edge of his vision began to move backwards.

"LINDY! Come out of that!"

The whine rose to a scream. Something pushed against Nyc's back and the trees speeded up. From the corner of his eye he saw Lindy pull something from her wrist and throw it among them. He concluded that he was now in the iron in which Unkullrod had arrived, and that he had been wrong to think that it only crept.

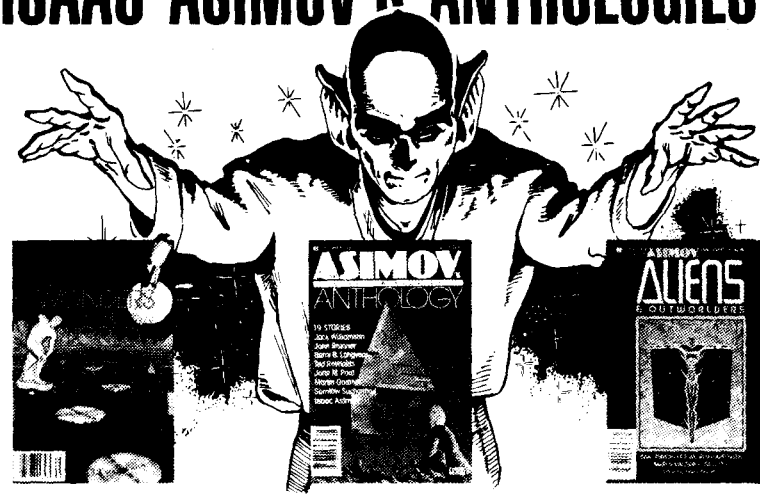
Lindy moved the stick that sprouted from the floor of the *running*-iron and it performed a sudden turn—the latest of many. Nyc had been thrown sideways by the first in the series and remained where he had been thrown. His view had been mostly of treetops. Now, abruptly, they disappeared.

The terrain over which the iron was moving seemed to be rougher than before. Several times Nyc caught a glimpse of a rocky pinnacle; twice, when his head was jolted forward, he got a momentary sight of a broad expanse of rock, much broken and dotted with boulders. The iron seemed to be slowing down.

Apparently it had not slowed enough. Perhaps two hundred heartbeats after they emerged from the trees Lindy uttered a sharp cry and pulled hard on the stick. A huge boulder appeared suddenly alongside, close enough for Nyc to have touched it if he could have moved his hand. The iron zig-zagged violently, tipped one way, tipped the other, and bounced into the air. Nyc was thrown out of it, somersaulted helplessly twice, and landed hard enough to knock the breath out of him. He heard Lindy scream; he heard a long, rending series of impacts somewhere close by; and he lay with his face in a clump of heather, unable to move.

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

OUT OF THIS WORLD READING at an OUT OF THIS WORLD PRICE... ISAAC ASIMOV'S ANTHOLOGIES!



Special Bargain—3 Volume Set—Only $11.97!

Please send me the anthologies indicated.
I have enclosed my check or
money order for $ _____.

Name _____

Address _____

City _____ State _____ Zip _____

Mail to: ASIMOV
P.O. Box 40
Vernon, N.J. 07462

ANTHOLOGIES

☐ #5, #6, #7—3 VOLUME SET ($11.97)

☐ VOLUME #5 ANTHOLOGY ($4.50)
☐ #6 WONDERS OF THE WORLD ($4.50)
☐ #7 ALIENS & OUTWORLDERS ($4.50)

MJGG-2

Please allow 6-8 weeks for delivery.

For orders outside the U.S. please add $6.00 for foreign postage.

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

* * *

Nyc's time-sense had shifted from counting heartbeats to estimating fractions of an hour, before the first prickling sensation informed him that his muscles were returning to life. The time elapsed since leaving the trees had progressed from one-sixth to almost one-half of an hour before the cramps which succeeded the pins-and-needles let up enough for him to raise his head from the heather-clump, and look around.

Something blurred his sight. He tried to brush it away, and discovered that he was still enclosed in the net. He fumbled his way out of it.

Shakily, Nyc got to his feet. Seen from the running-iron the landscape had looked rockily inhospitable; seen from inside, as it were, it looked worse. Bad for hunting, full of ravines through which other predators could creep up to rob Flyers of their prey, and with no high point for a quick take-off, except the rocky pinnacle he had seen earlier; which was about a hundred heartbeats away for flying, but would take at least a quarter of an hour to reach and climb on the hoof.

He could see no sign of Lindy or — more surprisingly—of the running-iron. Could she simply have ridden it away?

Nyc chewed his lip for a moment. As a rule the aerial senses were not much use on the ground, but possibly—

There were a great many hard-edged shapes around . . . but one of them had that peculiar straight-edged quality that Hornless Ones seemed to favor. Nyc had never had a good look at the running-iron, but this was nothing like his impression of it. . . .

It *was* the running-iron, however. This was what it looked like from underneath, with one end tipped up because the other hung over the side of a ravine.

"Lindy!" shouted Nyc, several times. The wind which blew among the rocks took the words and carried them away. He tried to find a shape softer than the rest.

A faint sound rose from the ravine.

Nyc tottered towards it. He was unsure of his balance—a new and detestable experience—so he dropped on hands and knees to approach the edge. He found Lindy with both senses; a soft-feeling patch deeper than the thinly-rooted vegetation, a collection of primary colors on grey,

She was lying on the far side of the ravine with her head in dangerous proximity to bare stone. Nyc, who could normally have reached her in one jump, scrambled awkwardly to the bottom and clawed his way to her side.

So far as he could discover her arms and legs were intact. There was a large swelling on the side of her head. She was breathing slowly, but not snorting like one Flyer who had hit his head and died shortly afterwards. Her heartbeat was slower than Nyc's own, but strong.

Even if she woke there was not time to get back to the big Flying Iron on foot, before dark. There was only one way to get help for her; he would have to find Unkullrod, or even one of the other Hornless Ones.

Nyc climbed out of the ravine—his legs were by now reasonably well under control—and set out for the rock pinnacles as fast as he could.

* * *

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

Soaring on the warm and rising breath of the forest, a-wing for the first time in two days, Nyc reminded himself that he was there to look for Hornless Ones; or rather for signs of movement on the forest floor. The canopy was a hindrance, but at least no animals were likely to be moving at this time of day. . . . The sun was quite low, however, before he found one moving object, towards the edge of his field of scan; veered in that direction, dropping lower, and found another. Eventually he had six in all, more or less regularly spaced and all moving at a walking pace.

Now which of those was Unkullrod? Nyc did not want to waste time scrambling around in the branches. He decided finally that one image was marginally sharper and clearer than the rest; closed in on it, dropped onto a tree about fifty yards ahead of it, and climbed down.

It *was* Unkullrod, his bald head now shiny with sweat. He was tramping steadily along a game-trail, shouting Lindy's name every twelve heartbeats.

Nyc dropped down a couple of branches and called softly "Unkullrod!"

"What! *Lindy!* Where are you?"

"Not Lindy," said Nyc, keeping the trunk of the tree between him and the Hornless One.

"Who the hell—"

"Lindy is—" Nyc decided that "seeming dead" would be tactless—"knocked asleep."

Unkullrod stared around him wildly, then appeared to get himself under control.

"Where are you? Come out, dammit! I won't hurt you."

"I am up here."

The Hornless One stared up at him and blinked.

"Right. Where is Lindy? How far?"

Nyc pointed. "That way. In a ravine. A sixth of an hour flying. No trees. Rocks."

"What happened?"

"I think—the running-iron ran too quickly. It tried to fly. I fell out. Lindy also."

"Is she hurt?"

"There is a lump on her head. No dent. She breathes."

"Can you take me there?"

Nyc had not thought this far.

"You cannot fly . . ."

"No, but—oh. You don't know the way on the ground? Is that it?" Unkullrod rubbed his chin with a hand which held a small iron of some sort. He blinked and held this up.

"The fool kid threw her comm bracelet away. Look. Can you take this and fly back to her? Then I can home on the screamer—"

The air whirled into a tight cone. Nyc, precariously balanced, was sucked off the branch, cannoned off the Hornless One and landed sprawling.

"Hey! Watch it—!" Unkullrod took a step forward, bringing the focus of the whirling that much closer. Nyc cried out and began to crawl away.

"What the hell—!"

Abruptly the whirling stopped. Nyc sat up.

"Do not make that again—!"

Unkullrod whistled.

"So old Quentin did manage to induce an electromagnetic sense in a pri-

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

mate brain. Farland got it wrong—again . . . Damn. Look, can you carry this to her *un*activated —er—dead, then put it down somewhere near her and I'll switch on the search beam and—No. That could be dangerous if I don't time it right. . . . You take it to her. Then you press this little knob—see? and then—well, throw it away if you like. If she's in a ravine and you get in it with her and keep your head down, it shouldn't bother you. Will you do that?"

Nyc regarded the bracelet with distrust.

"Why do you not send the small flying iron? It could see—"

"Because the bloody flying iron is in the middle of a complete overhaul after breaking down this morning. I'll have to send for a scooter. Tell Lindy I'm coming as fast as I can."

Floating above the trees Nyc discovered that he was tired. Not just physically—tired of Hornless Ones and the endless questions they inspired. Why had Farland ordered him to be stunned? Why had Lindy rescued him? . . . Why were they so *big?*

It occurred to him that he could simply leave the twisting-iron—the *comm*—with Lindy, walk or crawl beyond its influence, then take off and fly away. He would find a place to sleep, hunt food, and presently fly back to the Eyrie. Back home.

There was no real need to explore on this side of the mountains, not yet. Blue Wing or Long Leg or Lew Sipher had probably found a place for the new Eyrie already. By the time the Eyries ran out of suitable crags the Hornless Ones might have gone away.

* * *

He passed over the edge of the forest and hit the warmer air above the rocks. Soaring, he scanned the broken ground. All the ravines were full of shadow now, but it should be easy to see the bright hard colors of Lindy's outer covering . . .

Nyc did not see that. He saw a wolf, instead.

It was padding steadily along the bottom of a ravine—*the* ravine? The greyish-brown coat seemed to flow and ripple over the stone. Nyc dropped towards it and saw that a scraggly bush half way up the slope was moving jerkily as though someone was trying to use it as a shield. He remembered the bush—there was a hollow behind it, shielded by rock on two sides. Probably the best place available; not good enough to hold off a wolf.

Being caught by a wolf on the ground was the hunter's nightmare. Flyers did not bring down prey in wolf country, except when food was really short; nor then, unless there was a good takeoff point at hand. If a wolf appeared during the butchering it got the carcass, without argument. Anything else was suicide.

Wolves *could* be hunted from the air, though, if there was a good enough reason. Lillith, who might have been his birth-mother—he remembered other Xs teasing her when he had been naughty —had been caught on the ground by a wolf holed up in a cave nearby, and her fellow-hunters had attacked with their weighted spears and brought it down; though too late.

All this passed through Nyc's mind in a rapid burst, as he drew his cutting iron; took in the shape of the air, the

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

wolf's position and its rate of movement in one split-second; and dropped.

Even at the top the ravine was narrower than his outspread wings. Nyc snatched them inwards; they folded as he fell. In the last moment the wolf felt the wind of his passage and began to turn, but he hit it squarely in the middle of the back and the tip of the cutting-iron slid accurately into the gap between the spine and the skull.

The wolf gave a great upward bound, its back arching spastically. He kicked off and opened his wings just enough to slow his fall. He landed on the carcass an instant after it smashed to the ground, and leaped up, shouting:

"Lindy! The wolf is dead!"

"*Nyc!* Oh, Nyc, I thought *you* were dead, I thought I'd killed you!" The bush shook frantically as Lindy tried to disentangle herself from its thorns.

"Killed me?" Nyc had more or less forgotten about the accident to the running-iron. "I went to find Unkullrod. He will come."

The bush stopped shaking. "Is he very angry?" said Lindy in a small voice.

"Yes, because the flying iron is broken and he cannot come fast."

Nyc remembered the comm and took it out of his pouch. He climbed the wall of the ravine until his head was just below the rim, thumbed the little button and as the world twisted round him convulsively heaved the thing away as far as he could.

He slithered back into the depths of the ravine. Here the distortion was merely uncomfortable. Lindy had crawled out and was staring at the wolf.

"There won't be any more, will there?" she said.

"I think it was hunting alone, but there may be jackals. We should gather stones."

"I was going to set fire to the bush."

"You have a fire-maker?"

"I've got a lighter, yes."

There was not a great deal in the ravine that would burn. Still, even a small fire would be good. In a sixth of an hour it would be dark.

He grasped the handle of the cutting-iron, put one hoof on the wolf's head, and pulled. There was a snap. Nyc lost his balance and staggered backwards, staring in disbelief at the cutting-iron, which now had only half a blade.

From some way off came a distant yapping. He seized the nearest bush and began to saw at the base of the stem with what was left of the weapon.

Next time the yapping was a good deal closer.

Nyc threw the meager results of his cutting down to the floor of the ravine. It would be better to wait until the jackals actually came; the fire would not burn long. He started work on another bush.

"Nyc," said Lindy very softly, "what's that up there?"

He looked up at the rim of the ravine, now merely a darker line against a dark sky, and saw four snouted heads lifted to smell the air.

"Use your firemaker," he said. Though it was likely that one or more of the jackals would find the courage to spring before she got a spark.

The lighter, however, produced not a spark but a flame. Lindy touched it

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

to the dry, resinous brush. It flared up at once.

The jackal heads disappeared. Nyc started work on another bush.

"I can hear something," Lindy said.

The two things that presently roared up alongside the ravine were smaller than the running-iron, but a good deal louder. They wielded great rods of light that put the jackals into noisy retreat and threw chaotic gleams into the depths of the ravine. When the noise stopped a Hornless One walked to the rim. This one's head was very large, rounded and hard; until it removed a kind of shell and proved to have ordinary hair underneath.

"She's on her feet," it said over its shoulder. "I can check her better back at the ship."

"Give me a hand with the floater, then," said Unkullrod's voice out of the dark.

Presently there were metallic noises, followed by a resounding thud. Unkullrod walked into the lighted area.

"Lindy?" he said uncertainly.

Lindy rushed up the bank and into his arms. Nyc saw for the first time that she was much smaller than the other Hornless Ones. It slid into his mind, not simply that she was a youngling, but that he had been half aware of this for quite a while. It explained a great deal.

"Uncle Rod, are you very mad at me?"

"No, I'm too mad at that jackass Farland to spare any for you. But, hell, Lindy, I think you turned my hair white. . . . Those jackals I saw running away?"

"Yes, and oh, there was a wolf, only Nyc killed it—"

"*What?*"

"A wolf. Look, down there."

Unkullrod stared at the wolf's carcass for quite a long time. Then he stared at Nyc. A grinding noise came from above, followed presently by the whining of the running-iron. The strange Hornless One came to the rim of the ravine.

"She goes, more or less. I'll ride herd on you with the scooter."

"Can Nyc come?" said Lindy.

"Nyc can do whatever he likes," said Unkullrod. "How about it? If you want to sleep in the hide I'll see Farland stays away from you."

Nyc thought about trudging back to the pinnacle in the dark, and climbed in to the battered floater.

"Nerves of steel," said the strange Hornless One. "Right. Let's go."

Nyc woke to the sound of an altercation on the trail below.

"Morrow, as scientific director I insist on being present—!"

"Oh, yeah? What makes you think he'll stay there if you are? You're the one who got him stunned!"

"I—I—very well, but turn the recorder back on! And I have a list of questions—"

"Stuff it, Farland. You're the one who said alates would be speechless, remember? Old Quentin did a better job of repacking the brain than you gave him credit for. He did a better job all around than you're willing to believe. You sold me the idea I had a responsibility to check on his flying men. You drew a real harrowing picture of a pitiful race of semi-cripples, didn't you?"

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

Nyc sat up stiffly, discovering bruises he had had no time to notice yesterday.

"Don't try to pretend that's why you came, Morrow. You weren't even trying to save your ancestor's name. The tax people had a lot of questions you didn't want to answer and you took the excuse to skip."

"That? Every new government gets the idea it could take over the Institute. Maybe one day I'll let 'em. The farming lobby knows what would happen if seed production was run by bureaucrats. And if old Quentin really hijacked those embryos, good for him. They were going to be raised as high-quality serfs—"

"Instead of which, a lot of them ended in the waste bin! You heard that story the alate told Lindy—"

"I did. I'm not defending all that Quentin did. But if Nyc's anything to go by, he ended up by creating some damn good people, and I don't want them messed about."

"I have no intention of messing them about."

"No? You just want to go back to Deventer with a report that'll set every circus and zoo supplier in the inhabited volume roaring round looking for a ship to hire. Well, I'm putting a stop to it."

"Oh? And how do you propose to do that? You can hamper my work, but you can't keep this planet a secret. Do you suppose you can keep the crew from talking? Or my assistants—?"

"Yes, Farland, I do suppose just that. You forgotten that psycho-conditioner you insisted we had to bring?"

It sounded to Nyc as though Dokta-farland started a choking fit.

"You can't *do* that!"

"Why not? You wanted it done to your assistants, and the crew—condition them against talking to the papers or Tri-V. Stealing your thunder. The process doesn't hurt. I've had it done myself —nobody can get *my* trade secrets by slipping me a dose of babble juice."

"*No!* I've given years to my research on Morrow. I *discovered* his work on the alates. Damn it, you aren't concerned for *them*, you just want to silence me! This is my big chance for professional recognition—"

"Cheer up. We'll call in at Barrington Four on the way home. You can write a big thick report on what Quentin Morrow did for their agriculture, and all your pals'll put it in their bibliographies. Meanwhile, get out of my way. I've got someone important to see."

Fifty heartbeats later the bald head appeared at the top of the made-tree.

"I brought your breakfast," said Unkullrod. "What's the matter? Farland? I won't let him get at you."

Nyc was quivering with disapproval, not fear.

"You should not . . ." He could not find the words.

"Talk like that to an eminent scientist?" The Hornless One sounded actually amused.

"But he is one of your Eyrie! Your ship! You spoke . . . I do not speak of wolves so!"

"Farland's no wolf. A jackal, maybe." The Hornless One sat down and began to unpack the basket he was carrying. "How about a hard-boiled egg?"

There were oranges, also, and slices of the strange square-shaped roots, and

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

smoked meat of a kind Nyc did not know.

"Talking of wolves," said Unkullrod, "Lindy said you broke your knife. Can I see it?"

Nyc looked at it regretfully for a moment. It was older than he was. He passed it across.

"Where'd you get the metal?"

"There is a place near Black Rock where it grows in the ground."

"Did Quentin show you how to work it?"

"He showed the Firstmothers that metal must be heated and beaten, but it was the third Scratch who found it. He flew over that place and . . . and felt its shadow." Nyc tried without success to find better words for the effect of a large mass of meteoritic iron on the electromagnetic sense.

"Uh-huh. Well, I can't mend it, but maybe this would do instead."

This was a horn-handled knife about five inches long. Nyc touched the edge gingerly. A thin line of blood appeared on the ball of his finger. He could see his face in the blade.

Five of the Eyries had knives something like this, kept from the days of the Hornless One; but they were worn with much sharpening and the blades were scratched and dull. Onetree, as the latest one to split off, had none.

"It is very fine," said Nyc. "The Eyrie will be grateful."

"Look, son, I gave that knife to *you*. Because you saved Lindy's life. Since my brother died she's been like my own child, the only one I'll ever have. The knife is for you."

"I am of the Eyrie. What belongs to the Eyrie is mine when I need it. *I* am grateful."

Unkullrod scratched his head. "Yea . . . look, I wouldn't want you to think Farland is part of any Eyrie *I* belong to. He's one of my emp—my men, that's all. Works for my research institute. He got the idea that breeding crop plants wasn't intellectual enough and started researching my ancestor, old Quentin, in his spare time. Then he tried to blackmail me into funding his hobby—"

"Now I know why the Hornless One shot the Spoiled Flyer!" said Nyc.

"What? What d'you mean?"

"You say; *my* man. *My* youngling —*my* child. *My* ship. He said, *my* Flyers. They were his to do as he liked with. His to kill when they tried to take themselves away. Doktafarland is your man. Yours to . . . I do not know the word."

Nyc had wholly been absorbed in his discovery. Now he saw Unkullrod's face, and thought that he knew just how the Horneless One had looked when he reached for the killing-iron with the red light.

The look lasted only for a moment. Then Unkullrod laughed.

"My stars, you stick to your ideas, don't you? OK, it may have been a bad move to humiliate Farland. The man gets up my nose, but I guess I've got to live with him until we all get home. I'll do something nice for him; offer to pay for publishing his book on old Quentin, maybe—"

There was a thump, and the platform where they were sitting shook.

"What the hell—" said Unkullrod.

Nyc peered down. Doktafarland was

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

on the ground below, swinging a large long-handled cutting-iron against the base of the made-tree. Chips flew.

"Farland!" yelled Unkullrod. "What d'you think you're doing?"

"You—Morrow! Interfering with my work. Belittling . . . head of the Institute . . . just because your name's Morrow . . . "

The cutting-iron rose and fell steadily. One side of the made-tree was cut through.

"I've got more of his genes than you have. Ignorant lout. Can't tell a polygene from a polypoid. Damned ape. Keep you in the tree where you belong. You and that—"

Two Hornless Ones appeared, running. Nyc recognized the one who had stunned him yesterday. This one stopped, raised an iron—stunner? and pointed it at Doktafarland. The cutting-iron flew into the bushes. Doktafarland's arm swung above his head. He turned right round and crumpled quite slowly into a heap.

"Sorry, sir," called the one with the stunner. "Didn't know why he wanted the axe. You OK?"

"Get him to the sick-bay. Get me a ladder."

"Right."

Unkullrod sat down again on the edge of the platform.

"I suppose you think you called the shots on that one," he said.

"Shots?"

"You were right. I should have handled Farland more carefully. Didn't know he was so near the edge."

He looked sideways at Nyc. "Go on, eat. The food's not poisoned. I suppose you're going to fly back to your people? Far to go?"

"Yes. Far." Nyc peeled one of the eggs and bit into it.

"Don't tell me where."

Unkullrod picked up an orange and dug his fingers into the peel. Juice squirted into his eye. He threw the fruit violently from him and mopped the eye with a cloth.

"Your people tell stories, don't they?" he said. "That's how you teach the kids?"

Nyc had never thought of it quite like that, but it was true.

"Well, when you tell 'em about us—me, Farland, the ship—you make the story show that—Hornless Ones are bad medicine. One comes and wants to show you his nice big spaceship—say no. Keep away."

Nyc stared at him in silence.

"We aren't all bad, but all the same—another fifty years—that's about twenty-five orbits of this planet—it won't matter. There won't be any ships. Space travel is winding down. Too many colonies, no need to explore for more. As for trade, only luxuries are worth carrying, and who needs them? Planets have to be self-sufficient. Maybe in a thousand years we'll be building ships again. Four hundred and . . . seventy orbits. You reckon stories will be remembered that long?"

"We still tell the story of the Hornless One."

"Old Quentin. You don't hate him, either? You wouldn't talk to him the way I talked to Farland, suppose you got the chance?"

"He gave us our wings!—But if I saw

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

him I would fly away and warn the Eyrie."

Unkullrod nodded solemnly.

"You got the idea."

Nyc stood on the high cliff above the mouth of the long canyon, ten minutes before dawn. He had spent much of the previous day in a leisurely flight along the cliffs and had confirmed that they held as many crags and caves as those on the other side of the plateau. The night he had passed in a small dry cave, on a bed of pine tips, and slept well—the inflatable mattress which Unkullrod had lent him on the previous night had proved altogether too bouncy. This morning, to save carrying them, he had eaten what was left of a bountiful supply of provisions and drunk a cupful of water. The cup, and the shiny new knife, were all that he carried. Unkullrod had tried to give him several other things, but even one would have been too much weight.

He had said a difficult goodbye to Lindy—difficult, because he did not know what to say. She prattled away about the ponies and dogs and cats she was going back to, and the big house (a kind of made-cave) where she lived with Unkullrod.

Suddenly she said "Unkullrod says Humans could never stay friends with Flyers because whenever they come across a society that really works, sooner or later they have to test it to destruction. I think that's a terrible thing to say. . . ." Then she began to cry, and kissed him, and ran away.

The sky overhead turned, in a few heartbeats, from grey to blue. The sun was up, somewhere behind the mountains. Presently a stray beam made its way between them and was reflected like a star from the very tip of something among the treetops, several miles away. The star grew to a streak; the treetops bowed away from it. A huge roaring rose to the sky and rebounded from it as the great Flying Iron, which yesterday had erected itself to stand like a tree instead of a fallen log, pushed itself up from the ground. It seemed to hang in the air; then he could see that it was moving upwards, slowly, then faster; until it was a hurrying speck at the top of the sky. Until it was gone.

The Hornless One had come in his Flying Iron, and gone away again.

Nyc Livelong dropped into the air and started the long flight home. ■

MOVING? If you want your subscription to *Analog* to keep up with you, send both your old address and your new one (and the ZIP codes for both, please!) to our subscription department: Box 7061, Red Oak, Iowa 51566.

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

Dr. Robert L. Forward

THE NEGATIVE MATTER SPACE DRIVE

Long, long ago, in the August 1975 issue of *Analog*, I published the science "fact" article "Far Out Physics."[1] (I since have expanded the article and turned it into the book *Future Magic*.[2]) The article was based on a talk I gave to the 1974 Science Fiction Writers of America meeting in Los Angeles. In the talk I described six different kinds of antigravity devices, three time machines, two space warps, and a number of other far out ideas that I had collected over the years. One of the more interesting ideas was a space drive based on the concept of negative matter. I was hoping that one of the writers would pick up the idea of the negative matter space drive and write a story based on it. They didn't, so now I have.

Negative matter is a hypothetical form of matter whose mass is opposite in sign to normal positive matter. Negative matter is not antimatter, which as far as is known, has normal (positive) mass just like regular matter. I will show later that the gravitational field of negative matter causes all forms of matter, including negative matter, to move away from it, while the gravitational field of positive matter causes all forms of matter, including negative matter, to move toward it. Thus, as is shown in

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

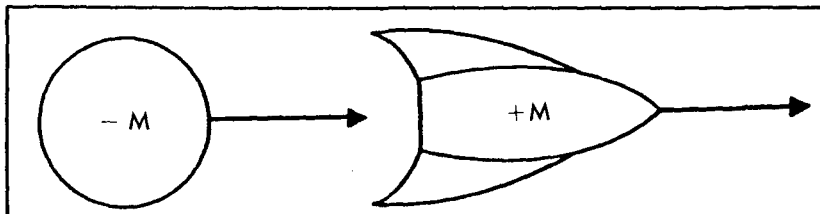


Fig. 1: Negative matter gravitational propulsion.

Figure 1, if we take a ball of negative matter of mass −M and place it near a rocket ship of positive mass +M of equal magnitude, then the negative mass will repel the positive mass, while the positive mass will attract the negative mass, and the rocket ship and the ball of negative matter will go off in the *same* direction with an acceleration equal to the gravity force between them. This truly miraculous negative matter space drive provides an *unlimited* amount of *unidirectional* acceleration *without* requiring either an *energy source* or *reaction mass!*

Now, at first glance, it seems obvious that this proves that negative matter cannot exist. The system starts out with two objects standing still, then after a while, the two objects are moving off in one direction with nothing going in the opposite direction. This *obviously* seems to violate the laws of conservation of linear momentum and energy.

Amazingly enough, it doesn't.

When the two objects are at zero velocity, the total momentum of the system is zero. After the two objects have reached the velocity v, their combined momentum is still zero,

$$P_+ + P_- = (+M)v + (-M)v = 0$$

because the ball made of negative matter has *negative momentum.*

There is also no violation of the law of conservation of energy. When the two objects are at zero velocity, the total energy of the system is zero. After the two objects have reached the velocity v, their combined kinetic energy is still zero,

$$E_+ + E_- = \tfrac{1}{2}(+M)v^2 + \tfrac{1}{2}(-M)v^2 = 0$$

because the ball of negative matter has *negative kinetic energy.*

In addition, it requires no energy to make the negative matter ball to run our miraculous negative matter space drive. As long as positive matter and negative matter are generated in equal amounts during the fabrication process, the total energy needed to create the rest mass for the combined system is zero,

$$(+M)c^2 + (-M)c^2 = 0$$

because the negative matter ball has *negative rest mass energy!* (At this point the audience usually breaks into incredulous guffaws, or at least stifled giggles.)

Recently, I presented this concept once again at a lecture for novice science fiction writers. The next speaker, the famous science fiction author, Larry Niven, was in the audience. During the

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

question and answer session after my lecture, he raised a question which seemed to lead to a logical contradiction that proved that negative matter was logically forbidden. Larry Niven's question was essentially this:

"Suppose the positive mass $+M_+$ is greater in magnitude than the negative mass $-M_-$ and the two are connected together by a stiff rod. The acceleration would, of course, be somewhat different than the case where the masses were equal in magnitude, but if they did reach any velocity v, then since the positive mass is greater than the negative mass, then a calculation of the total momentum would *not* produce zero:

$$P_+ + P_- = (+M_+)v + (-M_-)v = (M_+ - M_-)v \neq 0$$

In that case, wouldn't the law of conservation of momentum be violated?"

I couldn't answer him at the time. It took me many weeks of thinking and calculation before I got even a partial answer. Solely because of that single, simple question, I now have written and published a lengthy, tedious scientific paper.[3] The paper shows in excruciating mathematical detail that even if the positive and negative matter objects don't have the same magnitude of mass, and even if the coupling between the masses is mechanical or electrostatic instead of gravitational, the resulting behavior doesn't violate the laws of conservation of energy and momentum. In the process I found some interesting behavior when the two masses are different. I also found that for a "practical" negative matter space drive, you want to use elastic forces (e.g., a garage door spring) instead of gravitational forces.

Negative Matter

The first modern scientific paper to discuss negative matter was by Bondi[4], who gave a general discussion of the concept of negative mass in Einstein's theory of gravity, the General Theory of Relativity. Bondi showed that the concept of a negative mass chasing a positive mass with a constantly increasing velocity is consistent with General Relativity. Bondi's work was later expanded by Bonnor and Swaminarayan[5], who found an exact solution to the full Einstein field equations that accurately describe a uniformly accelerated pair of gravitationally interacting bodies with opposite masses as shown in Figure 1. The only difference between the Newtonian solution and the General Relativity solution is that, in the General Relativity solution, the two masses are not quite equal and opposite because they are being measured in an accelerating reference frame. For the two masses to keep a constant separation in the accelerated reference frame, the negative mass should be slightly larger than the positive mass.

There are three operationally distinct definitions of mass possible in Newtonian mechanics.[4] They are: active gravitational mass, passive gravitational mass, and inertial mass. The active gravitational mass of an object is that property that produces a gravitational field around the object. The passive gravitational mass of an object is that property that produces a force on the object when it is placed in a gravitational field pro-

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

duced by another object. The inertial mass of an object is that property that causes the object to accelerate when it is subjected to a force (of any kind).

In addition, the Einstein Special Theory of Relativity allows for an additional operational definition of mass, the rest mass. The rest mass M_0 of an object produces, upon conversion of the rest mass to energy, an amount of energy given by:

$$E = M_0c^2$$

where $c = 300$ Mm/s is the speed of light.

For normal positive matter, all the masses are equal and positive. It can be shown[4] that it is easy to violate the Newtonian laws of conservation of energy and momentum if the active and passive gravitational masses are not equal, but there is yet no reason why they cannot both be negative, or different from the inertial mass, or the rest mass. Speculation on these mixed-mass forms of matter is a topic for another article. For this article I will define negative matter as matter where all the different definitions of masses are equal and negative.

Gravitational Coupling of Two Point Objects

The first thing I did in my attempts to answer Larry Niven's question was to examine the case of the behavior of two objects made of opposite types of matter that did not have the same magnitude of mass and were coupled solely by their gravity fields. We all know that if the two point objects are made of positive matter, they will attract each other and fall toward each other. If one of the objects is much heavier than the other, the heavier one won't move much, while the lighter one will fall rapidly toward the more massive object. In actuality, of course, both move together toward their common center of mass.

Suppose we have two objects, one made of negative matter and one made of positive matter. They are separated by a distance r, where the positive sense of r is away from the negative object toward the positive object.

The negative matter object with an active gravitational mass of $-M_-$ will create a repulsive gravitational field A_- at the position of the positive matter object given by:

$$A_- = +GM_-/r^2$$

The direction of the gravity field is in the positive direction, away from the negative object, since its active gravitational mass is negative.

The positive object then responds to that gravitational field by producing a gravitational force F_+ proportional to its passive gravitational mass $+M_+$:

$$F_+ = +M_+A_- = +GM_+M_-/r^2$$

where the force is in the positive direction away from the negative object.

In a similar manner, the positive object creates an attractive gravitational field A_+ at the position of the negative object that points in the positive direction toward the positive object.

$$A_+ = +GM_+/r^2$$

The negative object responds to that gravitational field by producing a force F_- that is proportional to its negative passive gravitational mass:

$$F_- = -M_-A_+ = -GM_-M_+/r^2$$

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

where the force is in the negative direction away from the positive object.

The force F_- on the negative object causes it to move with an acceleration a_- that is inversely proportional to its negative inertial mass $-M_-$:

$$a_- = -F_-/M_- = +GM_+/r^2$$

where the acceleration is in the positive direction toward the positive object since the force F_- was away from the positive object and the negative inertial mass of the negative object acts perversely to the applied force.

In the same manner, the force F_+ on the positive object causes it to move with an acceleration a_+ that is inversely proportional to its positive inertial mass $+M_+$:

$$a_+ = +F_+/M_+ = +GM_-/r^2$$

where the acceleration is in the positive direction away from the negative object.

Note that since I assumed the passive gravitational mass and the inertial mass of each object are the same, even if they are negative, they drop out of the equations. The acceleration of an object in a gravity field is independent of the mass of the object and only depends upon the mass of the body generating the gravity field. This shows that a positive mass causes all other masses to accelerate toward it, while a negative mass causes all other masses to accelerate away from it. When I went through the detailed calculations, I found that if I assumed the magnitudes of the masses were equal, then I obtained the expected result that both objects moved off in the same direction at a constant acceleration.

If I assumed the positive matter object was larger, then the larger mass of the positive object attracted the smaller negative object more than the smaller mass of the negative matter object repelled the positive object, so the distance between the two objects decreased with time. On top of the motion closing the gap between the two objects, I found there was superimposed a unidirectional acceleration of both objects, the positive matter object leading the way. The velocity of the negative mass object was faster than the velocity of the positive mass object and it was catching up to the positive mass object, closing the distance between them. As the gap closed, the gravitational fields become stronger and the acceleration increased until the two objects collided.

If I assumed the positive matter object was smaller than the negative matter object, then the distance between the two objects increased with time since the large mass of the negative matter object was repelling the smaller positive matter object away. This motion was also accompanied by a unidirectional motion of both objects. In this case, however, the mutual gravitational fields and the acceleration levels decreased with time.

In all cases, when I calculated the net linear momentum of the system, it never changed from the initial value. Any increase in the positive linear momentum of the positive matter object was always balanced by the increase in negative linear momentum of the negative matter object.

When it came to conservation of energy, however, there *was* a difference.

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

The positive kinetic energy gained by the positive matter object was different than the negative kinetic energy gained by the negative matter object. When I included the mutual gravitational *potential* energy of the two objects, however, I found that the change in gravitational potential energy was exactly equal and opposite to the change in the kinetic energy.

Thus, after many days of tedious work, I finally obtained a partial answer to Larry Niven's question. Even when the two gravitating objects of opposite mass have different mass magnitudes, there is no violation of the laws of conservation of linear momentum and energy. But Larry had also mentioned using a stiff rod to keep the two masses and constant distance apart. My investigation of the "stiff rod" lead me to a detailed study of the behavior of two objects coupled by elastic forces, and the discovery of a more "practical" negative matter space drive that uses springs instead of gravitational forces.

Negative Matter Propulsion Using Springs

It turns out that since the force we can apply to a negative matter object with a strong, stiff spring, like a garage door spring, is much greater than the force we can apply using gravitational or electrostatic fields, a simple spring coupling gives us a highly effective and easily controlled space drive that can take us anywhere we want—at any acceleration we can stand.

To make the ideal space drive, we just need a negative matter object in the "engine" room that has a negative mass that equals in magnitude the positive mass of the entire ship. If we want to go forward, we pull a spring from the back wall of the engine room and hook it to the negative matter object. Immediately, the perverse inertial reaction of the negative matter object will cause it to accelerate in the forward direction, pulling on the tension spring, which pulls the spacecraft forward with an acceleration that is proportional to the strength of the spring.

To stop acceleration, merely unhook the spring.

To decelerate to a stop, replace the tension spring coming from the back wall of the engine room with a tension spring coming from the forward wall.

How much simpler can you make a space drive that gives you an unlimited amount of acceleration with no expenditure of energy or reaction mass?

Preposterous, you say? But in my scientific paper[3], I show that this negative matter space drive does not violate the classical laws of conservation of energy and linear momentum, even if the magnitudes of the masses are not the same.

Elastic Coupling of Two Objects

In the paper, I next studied in detail the case of two point objects coupled by an ideal, massless, tension spring. This was a more realistic version of "stiff rod" that Larry Niven had assumed could be attached between the two opposite mass objects to cause them to move at the same velocity. What we both had not considered was that the

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

stiff rod would apply mechanical forces to the two objects in addition to their mutual gravitational forces. I found that it was the "springiness" of a realistic nonrigid rod that kept the conservation laws from being violated.

In my paper, I assumed that the spring had zero initial length (difficult, but possible, to achieve in practice with a complex re-entrant spring design) and a tension force that was linearly proportional to the amount the spring had been extended. I first calculated the behavior when the two objects had positive masses. As expected, the two objects oscillated sinusoidally back and forth. If one of the objects was very massive, then the heavier object stood essentially still while the other object bounced back and forth with a frequency determined by the square root of the spring constant divided by the mass of the smaller object.

For the case where I assumed two objects of opposite mass, the force of the spring on the negative matter object caused the negative object to move *away* from the spring because of the perverse reaction of the negative inertial mass to the spring force.

Equal Mass Magnitude Case

If I assumed the magnitude of the positive mass was equal to the magnitude of the negative mass, then the accelerations of both objects were the same. This produced the expected but bizarre results that both the positive mass object and the negative mass object moved off at a constant acceleration that was proportional to the strength of the spring, the initial extension of the spring, and inversely proportional to the magnitudes (equal) of the two masses.

The total linear momentum of the system remained zero, even though both objects were moving off in the same direction at constantly increasing velocity. Because the magnitudes of the masses of the two objects were equal, the increased positive linear momentum gained by the positive matter object was compensated by the increased negative linear momentum gained by the negative matter object.

In the same manner, the law of conservation of energy was also not violated. The initial energy of the system was just the energy in the spring since the velocities of the objects were zero. The total energy of the system remained constant with time as the velocities of the two objects increased, since the increase in positive kinetic energy of the positive matter object was exactly compensated by the increase in negative kinetic energy of the negative matter object, while the extension (and therefore the energy) in the spring remained constant.

Negative Mass Magnitude Larger

If I assumed the magnitude of the negative mass was larger than the magnitude of the positive mass, then the equation of motion for the length of the spring changed. Instead of the spring staying at a constant length, the length of the spring oscillated sinusoidally. This is similar to the two positive mass case except that the frequency of oscillation of the spring now depended upon

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

the difference of the masses instead of the sum of the masses. On top of the sinusoidal motion of the spacing between the two objects was superimposed a sinusoidal motion of the combined system, first off to one side, then the other side.

It is interesting to note that for the case where the magnitude of the negative mass was much larger than the magnitude of the positive mass, then the frequency of oscillation was the same frequency that would be obtained if the larger object were made of positive matter and were acting as a large, nearly motionless, inertial body, while the smaller mass oscillated back and forth at the end of the spring. Thus, from an inertial viewpoint, a large negative mass behaved like a large positive mass.

If I assumed that at the initial time, the objects were at zero velocity and the spring was at its maximum extension, then the objects were found to be at one of their maximum deviation points from their oscillation midpoint. As time proceeded, they moved toward the midpoint together, the negative mass leading the positive mass. The lighter positive mass, moving faster, caught up with the negative mass, which decreased the distance between them. This, in turn, decreased the spring force and the acceleration levels.

I found that the spring length and the spring force became zero at the midpoint and the two objects switched places (I assumed they were ideal point objects and could pass through each other without colliding). The spring started to stretch, the spring force went up, the positive mass (now leading the way) was decelerated and slowed, while the negative object pulled perversely in the opposite direction. The velocities of the two objects then decreased, both becoming zero when the end of the oscillation was reached. The spring had now reached maximum extension and the spring forces and the acceleration levels were at their maximum again. The objects then started moving in the opposite direction.

If I assumed the magnitude of the two masses approached each other, the frequency of oscillation approached infinity, and the behavior of the system approached the unidirectional, constant acceleration case where the two masses were equal and opposite. I then calculated the total linear momentum and the total energy of the system for any point in time during the oscillation. As long as I included the energy stored in the stretched spring, there was no violation of the laws of conservation of energy and momentum.

Positive Mass Magnitude Larger

If I assumed the magnitude of the positive mass was larger than the magnitude of the negative mass, I found the behavior was exponential instead of sinusoidal. After an initial transient which involved both an exponential growth and an exponential decay, the exponential growth took over. Both objects moved off in one direction, with the negative mass leading and the positive mass following. Since the less massive negative matter object moved faster than the positive matter object, the spring

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

stretched. The increased spring length increased the spring force, and the system accelerated at an exponentially increasing rate. If the magnitudes of the two masses were almost equal, then the motions of the two masses were similar, the spring remained nearly constant in length, and the behavior of the combined system approached the constant acceleration case. Again, I found no violation of the conservation laws.

Coupling of Masses Using Electrostatic Forces

Although real negative matter particles (if they exist) may not have convenient "handles" to hook a spring to, and may not be dense enough to produce significant levels of gravitational forces, they may be massive enough to be useful and also have an electrical charge. The electrical charge would give us a "handle" on the negative matter particle that could be used to "push" and "pull" the particle at a distance using electrostatic forces. Electrostatic forces may also be used to build a computer controlled active "trap" that can capture and collect large numbers of negative matter particles (provided they exist and provided they are charged).

I also carried out a detailed analysis of the interaction of a positive matter object and a negative matter object coupled by Coulomb electrostatic forces. I obtained the same results of unidirectional motion of the combined system at an acceleration proportional to the strength of the electrostatic force. Again, there was no violation of the laws of conservation of momentum and energy. You will have to take my word for it, as the analysis was far too long to include even in my scientific paper.

The "Nullor Drive"

In my next science fiction novel (tentatively entitled *Timemaster*), my hero will be using a "Nullor Drive." It is a gravitationally coupled device that combines the near ideal propulsion capabilities of the negative matter space drive with the high acceleration capabilities of the spacecraft Charles Sheffield describes in his novel, *The McAndrew Chronicles*.[6]

The Nullor Drive uses two massive rings of circulating particles. One is made of ultradense positive matter and one is made of ultradense negative matter. The positive matter ring is in the "forward" portion of the squat cylindrical spacecraft, while the negative matter ring is in the "rear." The positive matter ring causes the negative matter ring to accelerate toward it, while the negative matter ring causes the positive matter ring to accelerate away from it. Thus, the basic propulsion mechanism of the spacecraft is a gravitationally coupled negative matter space drive.

For the purposes of the story (to keep my hero young, to keep the reader from getting bored, and to bring in the relativistic time dilation effects I want to use later), I need to have my hero travel at significant fractions of the speed of light as he sets up his commercial empire between the various stars in the local solar neighborhood. If I limit the acceleration of the ship to one gee, it will take him a year to get to 70% of

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

the speed of light. This is too long. To get him up to the speed of light in a hurry, I need to accelerate him at 100 gees so he can reach 90% of the speed of light in a week. Unfortunately, the human body can't take 100 gees for very long, which is where the other part of the Nullor Drive comes in.

The Nullor Drive uses gravity for both propulsion and high acceleration protection. If the two rings are made with a radius that is 1.414 times the separation distance, then it can be shown that the gravitational acceleration applied to a person in a cockpit near the center of the two rings is the same as the acceleration applied by the rings on each other. The positive mass ring pulls the pilot at 50 gees, the negative mass ring pushes the pilot at 50 gees, and these two forces combine to cancel the inertial reaction force to the 100 gee acceleration of the spacecraft.

To get 100 gees of acceleration while providing reasonable dimensions for the zero gee cockpit region (a few meters in diameter) requires that the positive and negative matter rings have a mass of about 10^{12} tons (an asteroid 10 km in diameter). In order to get that much mass concentrated in that small a region it will have to be collapsed into ultra-dense matter.

To attain lower acceleration levels, the rings are moved further apart and increased in radius. The zero gee region enlarges dramatically, until at 4 gees the room available approaches that of a large mansion, except this mansion has some strange floors. On the middle floor we have the zero gee pool surrounded by rooms for flying, acrobatics, and other zero gee sports. Above and below are the lunar gravity floors for easy living, while the next floors in each direction are at Earth gravity to keep you in shape. The direction of gravity on these floors is in the direction of the inertial reaction force.

If you are right in the middle of the two rings, the positive ring pull and the negative ring push just cancel the acceleration. If you move toward the positive ring its pull actually decreases since you are getting closer to the center of the ring. (At the center of a massive ring of positive matter, the net gravity field is zero since the pull of the ring on one side is balanced by the pull of the ring on the other side.) Similarly, the push from the negative matter ring decreases since you are moving farther away from it. Since both the push and the pull are decreasing, they cancel less of the inertial force. The result is a net acceleration toward the rear of the ship.

If you move toward the negative matter ring and away from the positive matter ring, the negative ring push decreases because you are getting closer to the center of the ring, while the positive ring pull decreases because you are getting further away from it. This again produces a net acceleration toward the rear of the ship. I am having fun exploring the ramifications of life aboard such a spacecraft.

Where Is It?

The purpose of my scientific paper[3] was to emphasize to the scientific community that the concept of negative matter is not logically forbidden. In physics, there is an unwritten law that

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

if something is not forbidden, it is compulsory. If negative matter is not logically forbidden, then where is it? There do exist some clues that may point to places where negative matter can be found.

One clue that there may be large amounts of negative matter in the Universe can be found in papers discussing the huge voids found in large scale 3-D "maps" of the Universe.[7] As shown in Figure 2, these "bubbles" are 100 million light-years across (our Milky Way Galaxy is a mere 0.8 million light-years across). The bubbles are sharply defined by large numbers of galaxies that seem to lie on the surface of the bubbles. There are almost no galaxies *in* the voids, and those that are found there are very unusual galaxies characterized by strong, high-excitation emission spectra.

One possible explanation for this "frothy" structure of the present-day Universe is that the Universe was formed with equal amounts of negative matter particles and positive matter particles. (This has the nice feature that the net mass of the Universe is zero.) The "voids" are full of the negative matter objects trying to keep as far away from each other as possible, meanwhile pushing the positive mass objects to the surface of the voids where they attract each other to form galaxies, stars, planets, and us. One way to test this hypothesis is to use some of the available computer models for Universes to see if an equal mixture of positive and negative matter would separate out into regions similar in size and shape to those observed.

In addition, if there are large numbers of negative matter particles in the Universe, then positive masses, like our Sun, will attract those negative matter particles. As Terletskii[8] has pointed out, when the negative matter particles strike the positive matter particles in the Sun, they don't slow down, but continuously accelerate. In the process, they gain

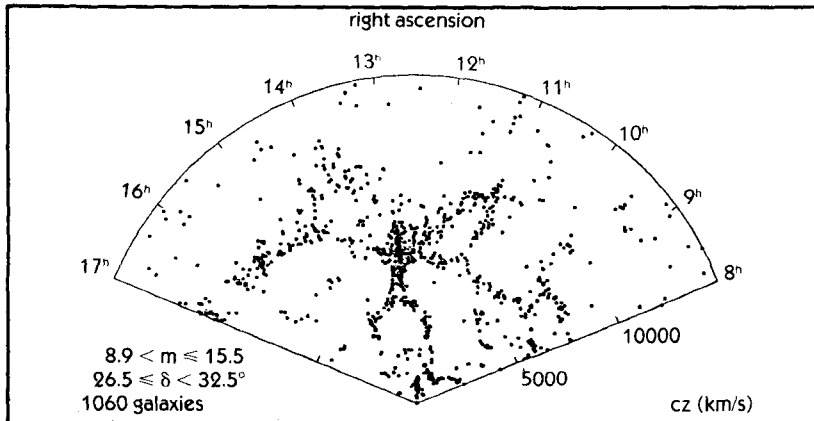


Fig. 2: A slice of the Universe.

(From V. de Lapparent, M.J. Geller, and J.P. Huchra[7])

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

negative kinetic energy and put positive kinetic energy into the positive matter particles, heating the Sun up. Terletskii argues that because of the absence of the catastrophic heating of the Sun, then either there are very few negative matter particles (read none), or their interaction cross-section is low. It could be, instead, that there *is* heating of the Sun by an influx of negative matter particles and this is why the fusion neutrinos observed coming from the Sun are only one-third that calculated assuming all the energy in the Sun is generated by thermonuclear fusion plus gravitational contraction.

The reason negative matter particles have not been seen may be because a process called "nullification" is taking place. During the nullification process when a negative matter particle physically contacts a positive matter particle they would both disappear, just like the annihilation process that occurs when antimatter meets matter. In the nullification process, however, no energy is released since the net rest mass of the negative matter particle and the positive matter particle is zero. With no energy released, there is nothing for scientific instruments to detect.

In my novel, I will have my hero discover and gather this postulated flux of negative matter particles so he can produce the negative matter space drive that I need to make the story work. It would be nice if the real world were as easy to manipulate as fictional worlds. But you never know, perhaps it is. What the space community really needs is a non-polluting, infinite range, effortless propulsion system like the negative matter space drive. Maybe if someone will go out into space and look for negative matter, we will find just what we need to build one. ■

References

1. Robert L. Forward, "Far Out Physics," *Analog Science Fiction/Science Fact*, Vol. 95, No. 8, August 1975, pp. 147-166.

2. Robert L. Forward, *Future Magic*, Avon Books, New York, 1988.

3. Robert L. Forward, "Negative Matter Propulsion," *Journal of Propulsion and Power*, Vol. 6, No. 1, Jan-Feb 1990, pp. 28-37. (For a free reprint of this paper, send a large 45¢ SASE to P.O. Box 2783, Malibu, CA 90265)

4. H. Bondi, "Negative Mass in General Relativity," *Reviews of Modern Physics*, Vol. 29, 1957, pp. 423-428.

5. W.B. Bonnor and N.S. Swaminarayan, "An Exact Solution for Uniformly Accelerated Particles in General Relativity," *Zeitschrift für Physik*, Vol. 177, 1964, pp. 240-256.

6. Charles Sheffield, *The McAndrew Chronicles*, Tor Books, New York, 1983, pp. 72-112, 234-5.

7. Valerie de Lapparent, Margaret J. Geller, and John P. Huchra, "A Slice of the Universe," *Astrophysical Journal*, Vol. 302, 1986, L1-L5.

8. Yakov P. Terletskii, "Negative Masses and the Energy-sources of the Universe," *Experimentelle Technik der Physik*, Vol. 29, 1981, pp. 331-332.

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

Special Feature

IF IT CAN BE DONE, NATURE'S DONE IT ALREADY

William R. Warren, Jr.

Arthur C. Clarke

Man never invents anything that Nature hasn't tried out millions of years earlier.

Look at flying; would we ever have thought of such a crazy idea, if the birds, the bats and the bees hadn't first shown us that it was possible? Here are a few more examples, in no particular order.

Air-conditioning? How do you imagine the termites keep their vast and complicated "cities" cool in the tropics? They also invented agriculture, around the time of the dinosaurs (give or take a few million years) and operate highly efficient fungus-farms.

Fluorescent lighting? Yes, fire-flies are an obvious example, but not a very impressive one: deep-sea fish put on infinitely more spectacular displays. The Marianas Trench on a Saturday night puts Times Square to shame.

Even rotary motion—until recently regarded as a human exclusive—has now turned up in the microworld. Believe It Or Not, there are bacteria with *propellors*.

And look at that wonderful twentieth century invention, the jet. Squids were jet-setting across the oceans long before the Concordes and 747s got into the act. Not quite so fast, of course: but what's the big hurry?

While we're on the subject of

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

squids—admittedly not the most wildly popular conversational gambit—here's another one for Ripley. No TV screen can beat the display a squid can put on *over its entire body*, changing pattern and color in the twinkling of an eye. To match this amazing feat, a human being would have to produce instant tattoos.

Rockets? Well, there's a beetle that mixes violently reactive chemicals in its guts to produce a blast of scalding steam. Though it does this to discourage predators, I wouldn't be at all surprised if some relative in the Borneo jungles has taken the next step and developed JATO—jet-assisted take-off.

Perhaps the worse shock to our pride was the discovery that WWII's secret weapons, radar and sonar, had been anticipated by bats, dolphins, whales—and doubtless other creatures we haven't discovered yet. (As the old riddle goes: "Which is the most cunning of the animals? That which no man hath yet seen.")

If you think we're still ahead because bats, etc., use sound waves while we sophisticates use radio, don't push your luck. Electric eels are an amazing (I almost said 'shocking') example of what Evolution can do when it really sets its mind to it. Yet now it seems that Nature's equivalents of Con Edison do more than merely stun their prey; some fish use the electric fields they generate for navigation and obstacle detection. Which is the next best thing to genuine radar.

It was while contemplating such wonders of the animal kingdom that I formulated this working hypothesis: "If it *can* be done, Nature's done it already." After all, she's had long enough to experiment, so we Johnny-come-latelies shouldn't feel too embarrassed.

And this led to a further thought: Are there any examples in Nature of technological breakthroughs that still elude us? Well, by golly, there's a big one. Fasten your seat belts . . .

We achieved space-travel by the use of rockets—devices which propel themselves in one direction by ejecting matter in the other. According to Newton's Third Law, every action produces an opposite reaction. Ships, aircraft—even automobiles and people—all get around thanks to some application of this Law, though the rocket is its most clear-cut example. And the *only* one that will operate in the vacuum of space, because it carries its reaction mass with it in the form of the fuel it ejects after combustion. (I spent most of the '30s explaining why the rocket doesn't need any "air to push against.")

But rockets are expensive and inefficient: look at the ratio between payload and take-off mass of the *Saturn V* which carried the Apollo astronauts to the Moon. And, as we are now sadly aware, they are potentially dangerous. Their "controlled explosions" sometimes aren't.

Not surprisingly, for a long time science fiction writers have dreamed of a "Space Drive" which could get us to the planets in a more civilized manner, without all that noise and fuss. Every few years some hopeful inventor claims to have demonstrated such a device, usually depending on gyroscopes or vibrating masses to produce a unidirectional thrust. They have all come to grief on Newton Number Three; it always

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

turns out that Action and Reaction cancel exactly.

What we want, remember, is a *totally closed system which can produce motion without ejecting any matter;* all it needs is some source of internal energy to produce a thrust. Impossible, conventional physics says. Well, I have news for you. Once again, Mother Nature has beaten us to it—and shown us the *real* way to the stars.

And I do think it's ironic that the American rocketeers of the late '40s, down at White Sands, New Mexico, had the proof right under their noses. They only had to go across the border to find—the Mexican Jumping Bean!

Scaling-up is, of course, a straightforward engineering problem but look what the Atomic Bombers did with a sample of U235 barely visible to the naked eye.

And remember—you read it here first! ■

The author of this essay is the result of a spectacularly unsuccessful attempt to clone, before it's too late, a well-known science-fiction writer and armchair astronaut.

SCIENCE FICTION analog SCIENCE FACT

BACK ISSUES AVAILABLE

If you have missed some issues, check off what you'd like and mail with your check or money order. Supplies are limited. Please allow four to six weeks for delivery.

January 1989 ..... ☐	August 1989 ..... ☐
February 1989 ..... ☐	September 1989 ..... ☐
March 1989 ..... ☐	October 1989 ..... ☐
April 1989 ..... ☐	November 1989 ..... ☐
May 1989 ..... ☐	December 1989 ..... ☐
June 1989 ..... ☐	Mid-December 1989 ... ☐
July 1989 ..... ☐	

MAIL TO: *Analog Science Fiction/Science Fact*
P.O. Box 40 • Vernon, NJ 07462

Enclosed is my check or money order for $ _____ to cover _____ copies at $3.50 each. (price includes postage and handling.)

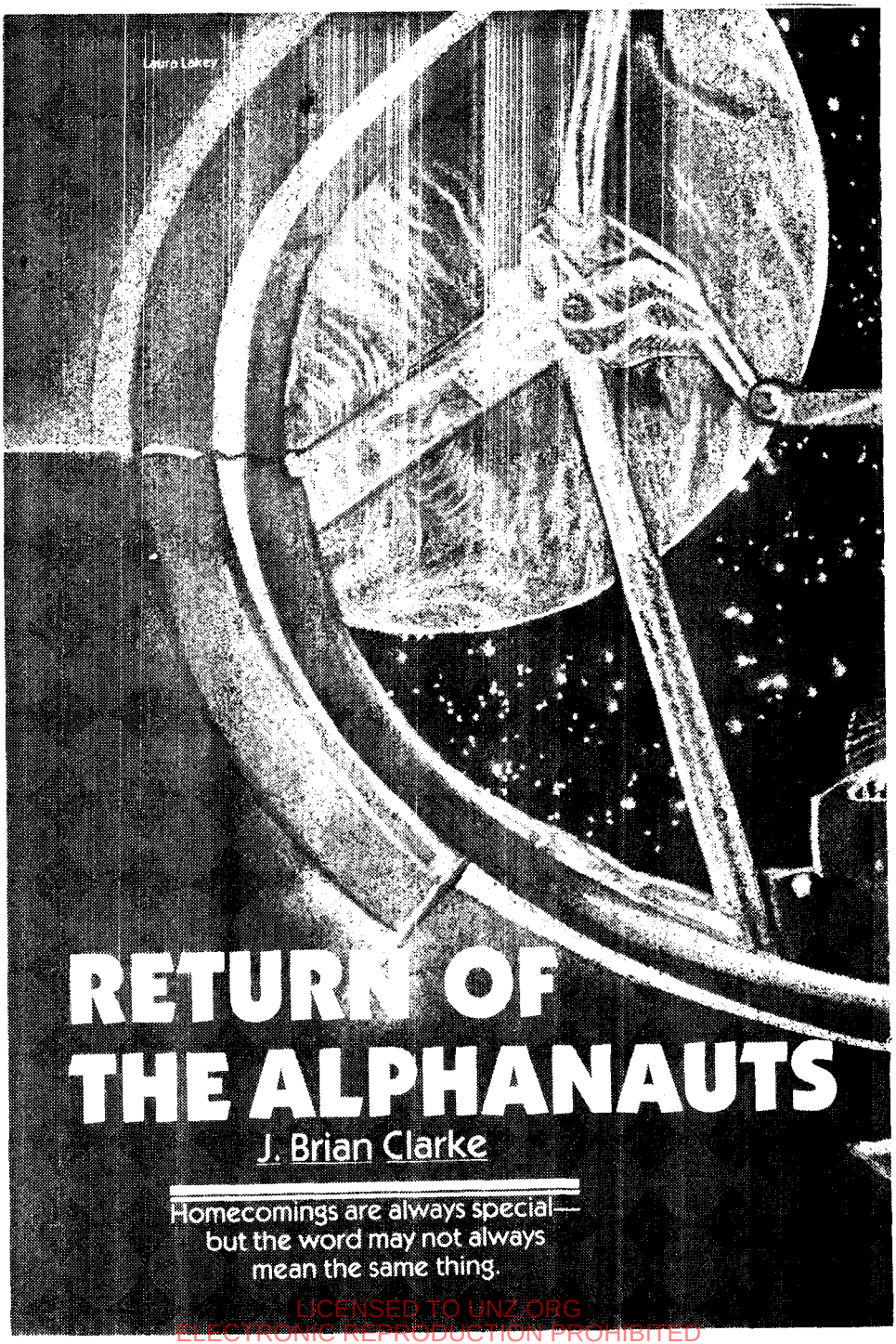
MJKC-6

name _____

street/no. _____

city _____ state _____ zip _____

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED


Laura Lakey
RETURN OF THE ALPHANAUTS
J. Brian Clarke
Homecomings are always special—but the word may not always mean the same thing.

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

The three-year quarantine was almost over. As I stood beside my bed and began to pack my few personal belongings, I tried not to think of the inevitable difficulties which lay ahead, of trying to resume a life style I had almost forgotten. I was in limbo, between a world to which I could not return, and a world to which I did not want to go.

First I packed the souvenirs I had put aside for special handling. Although part of me wondered if it was such a good idea to keep these bits of realism around while time and memories softened what had been in the past, the other part insisted; why not? The six of us had, after all, been part of an endeavour beyond anything in human history. We deserved our trophies!

Item. Three vials banded together. One contained the corpse of an insect-like creature, another a ball of fluff, the third a tiny plant with a thick stem and pinhead-sized gray leaves. Not much to the uninformed eye, perhaps. But the mind behind that uninformed eye would not know that these were three stages in the life cycle of the same life form.

Item. Another vial, this one filled with a clear liquid. It was only water. But it was water which had been collected in the mist below a great cascade which plunged an uninterrupted three thousand meters down the side of a fault which split a continent.

Item. A package of samples including plant and animal matter, and material which shared the characteristics of both. A slender piece of vine with a tensile strength approaching that of steel. A piece of wood which, when heated, could be molded like soft putty.

The samples were followed by my finger camera and a package of chips containing God knows how many thousands of exposures. Not, of course, as extensive as the official visual record. But a man needs to do something of his own during a misson of such extended duration. Howard Scheckart, for instance, had taken to painting. Although the botanist's gloomy landscapes were too depressing for my taste, I did not doubt that at least a few of them would ultimately hang in many of the world's major galleries.

My instrument and sample belt. I coiled it carefully, despite the fact it was scarred and frayed as if it had been dragged through tightly wound barbed wire. It had happened when my lift pack failed over one of the thorn forests. My body still bore the marks inflicted by those vicious barbs. The belt had, however, continued its usefulness; a proud record considering it outlasted several sets of armorcloth coveralls.

I lifted a sealed plastic envelope up to the light. The envelope contained a few blades of grass—nothing more. But those slivers of faded green were from a lawn which logic dictated could not be grown. Young Eric Gerenson however, communications specialist and former street kid from one of the concrete jungles of western Europe, thought otherwise. He had not, he insisted, smuggled two kilos of grass seed all the way from Earth for nothing. So he had consulted the ship's library, prepared the proper nutrients, even contrived a sprinkler system which pumped water from a nearby stream. He had fussed, worried, made a thorough fool of him-

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

self, and after a few months created the lushest lawn on the fifth planet of Alpha Centauri. Actually, it was the only lawn. But it was fortunate its survival had depended on such loving care. Otherwise, the next expedition might find the local ecology drowned under an ocean of waving green.

More oddments went into the bag, including a small abstract carved by Victor Kraskinn just before the geologist lost his right arm in a rockfall. Finally, the few letters I had received only hours before the *Robert L. Cassion* moved out of luna orbit and began its journey to the Centauri system. I looked the letters over. There was a polite farewell from Ron, typed on office letterhead. We had not seen each other for years anyway, so he could hardly be expected to gush over a brother he hardly knew. A couple of letters were from people I had worked with during the second Mercury expedition. I had largely lost contact with them also, especially after I transferred to the Interstellar Project.

Maylene's last letter. More personal than the others, but that was to be expected. Would I have married her if I was not on the project? I suspect I would have. May was one in a million; I would have been a fool not to. Then again, I had only met her because she happened to be one of the project's technicians, so the question was academic in any case. Another of life's not-so-minor ironies.

The last letter was on cheap, brittled notepaper, so I handled it gingerly. But the childish scrawl was still legible. As I read it again, my memories of her earnest little face were as clear as they had been—how many hundreds of readings ago?

Darling daddy, she had written. *Please do not go away too long. Auntie Pol has told me you are going to a star, not like mommy, but in a space ship. She said we cannot see the star from Vancouver, so I hope she and Uncle Hector will take me where I can see it sometime. When you come back, please bring me a star teddy. Love, Cheryl.*

I wished I knew what a star teddy was, but it had been too late to find out. I hoped the painstaking model I had created from local materials and imagination, would be an acceptable substitute. My daughter was older now, but surely she would remember and understand.

Damn the quarantine!

It was not the three years of confinement on the Moon which bothered me, as much as the fact no outside communication was permitted either way. Officially, no one even knew the *Robert L. Cassion* was back from the Centauri system! I did not doubt that except for the U.N.S.A.A. brass who were in on the deception, not to mention those who had forgotten us anyway, most of the billions on that blue-white world in the luna sky probably assumed we had expired somewhere out there in the great dark.

The reason for the quarantine was logical enough. The statistical possibility that we could be biological time bombs was nothing new; it was a factor which had even been taken into account when the first astronauts returned from the Moon a couple of centuries ago in 1969. But their quarantine had lasted

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

only eighteen days. Ours was three years!

That root cause of our frustration was discussed by Eratosthenes administrator Dr. Curtis Paoli, at the first of our weekly joint briefings. In his gentle way, it was a reminder. "There are six billion people down there, and only six of you alphanauts." *(I hated that ridiculous name, especially the anonymous idiot who dreamed it up. But we were apparently stuck with it).* "With those odds, how can you possibly object to us making absolutely sure you are biologically safe? And need I also remind you that a motion to extend the quarantine to forty-two months, right into the red-line zone, was defeated by only one vote? Gentlemen, I suggest you consider yourselves extremely lucky."

"Lucky, my eye!" angrily snapped Gellan DeZantos, the expedition's astronomer. "Dammit, you cannot transmit a plague over the radio! So why won't you let me call my Earthside colleagues? Why can't any of us?"

Curtis patiently repeated what we already knew. "Gellan, no one will be allowed to communicate with those who do not know you exist. And it has to be that way, because of what you are and what the media—the most powerful political lobby on Earth—can do with it. All right, I admit most news people can be trusted to do the right thing. But not, unfortunately, all of them. In other words, I am telling you that if certain unscrupulous bottom-liners find out what is going on, they can pull enough political strings to end this quarantine within a year at the most. If that happens—"

I will never forget the look of absolute determination on Curtis's face.

"—if that happens, I will destroy this facility and everything and everyone in it!"

He was addressing the alphanauts as if, at that moment, no one else existed. I remember the cold chill which ran up my spine as I realized that Curtis did not need to speak to the others in the room. Not only had they already accepted the grim possibilities when they signed on, I did not doubt some of them had helped prepare and conceal the explosive charges which gave reality to Curtis's threat. Which made me resentful. After all, they were volunteers. The six of us, on the other hand, had no choice.

Nevertheless, despite the sword of Damocles which Curtis had hung over our heads, it turned out to be not such a bad life. There was always work to do, especially with the samples and the reams of data we had brought back from Alpha Five. The place of our exile was luxurious beyond belief, with every imagined creature comfort including a swimming pool and a well-equipped gymnasium. The small holo-theater frequently showed the latest shows from Earth, and by the end of the first year we even had our own theatrical repertory company. Yet every time the roboshuttle arrived with fresh supplies, there was fierce, sometimes acrimonious competition for the privilege of belonging to the four-man unloading crew.

As far as other needs were concerned, it was fortunate that U.N.S.A.A.'s funding was no longer subject to the political whims of the United Nations House of Assembly. The cabal of Mos-

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

lem-Christian fundamentalists who had dominated the Assembly for too long, and who had threatened financial termination if all-male crews were not used on the interstellar projects, had finally succumbed before the onslaught of twenty-second century pragmatism. Which, thank God, was why twenty of the thirty-four who were assigned to the Alphanaut Project were women. A few couples were already married to each other when the two shuttle-loads arrived from Earth to set up house under Eratosthenes, and within six months several more signed contracts. Although none of the alphanauts entered similar commitments, only the monkish Howard Scheckart chose to remain celibate.

As I closed the bag and pressed an identification label to its side, I wondered if I would see much of Joan after we returned home; if indeed I had made a mistake when I told her I would consider nothing permanent until I became fully adjusted to life Earthside. I suspected her feelings for me were stronger than she admitted, although that could be mere conceit on my part. One thing I did know. Her pride would never accept the implication: *You'll do if no one else turns up.*

The P.A. announced, "The final briefing will be in the lounge in fifteen minutes. Unless you are on essential duty, please attend."

I left my room, walked down the corridor and tapped on her door. "Richard. Can I come in?"

"It's open," she called cheerfully.

Joan was also packing, but she looked up with a smile. "One to go," she said, referring to our private countdown. "Nervous?"

I grimaced. "Does night follow day?" I walked over and kissed the nape of her neck. "I only ask that you stay around for a while. I have grown accustomed to your face."

Although I tried to sound jocular as I voiced the old cliché, I did not fool her. She knew me too well. "Richard, you are uptight. I know it is difficult, but please try to relax."

"Try to relax," I mimicked bitterly. "I bet you say that to all your patients."

She nodded. "I do, as a matter of fact. But with you, it is more personal. Can't you hold on to that? To *us?*"

It was a good point. Besides being a top-notch psychologist, Joan Walsh also happened to be a lovely lady—and I am not just referring to the fact she was a lissome redhead who could turn the head of a saint. She had become my better, my saner half, which was a substantial plus for meteorologist/alphanaut Richard Burret.

She smiled again, touched my face with her finger tips and added, "I will be with you every step of the way, dear." She put a filmy thing into the case and snapped it shut.

Guess I won't see that again, I thought wistfully. I blinked, forced my attention to more practical matters. "What do you think Curtis is up to? We have already been briefed to death."

"Which is what I think, too." She considered a moment. "Perhaps Curtis is hooked onto the image of himself as a father."

"Ah—I beg your pardon?"

"If you are the head of a large family

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

which is about to break up, won't you at least want to wish everyone well?"

"Well, I suppose—" I chuckled. "You figure we are in for a little parental advice, huh?"

"It is my guess," Joan said seriously. "After all, we have all been away from home for a long time. So you cannot fault our lord and master for wanting to make sure he is not about to unload a collection of anachronistic misfits." She tucked her arm within mine. "Time for us to find out."

The Eratosthenes complex had originally been constructed to house the deep-space research unit of the now-defunct U.N. Academy. After the U.N.A. folded, the United Nations Space and Aviation Authority took over Eratosthenes for future considerations. So when the first signals were picked up from our returning ship, it was only necessary to make minor adjustments within U.N.S.A.A.'s regular budget to prepare the old base for habitation, while at the same time keeping the lid on one of the best-kept secrets of the twenty-second century. No outside people were used. It was entirely Curtis and his group who performed the necessary physical and administrative work to prepare our home-away-from-home. And after we six arrived, there were three years during which the maintenance of the base and its life support systems became the responsibility of everyone. It was the kind of life-depending situation in which discipline is as important as the hydroponics.

Not that we were organized in a military fashion; Curtis was too much of an individualist to want to treat us other individualists like soldiers. Yet his natural persuasiveness, his willingness to be a human lightning rod, and above all his ability to sense and then to control irritants, were qualities which kept us all on a reasonably even keel for three interminable years.

But it was all behind us now, or nearly so, and as my companion and I joined the others in the lounge, we sensed a puzzled expectancy which more or less matched our own. "Isn't it strange?" Joan whispered as we found a couple of unoccupied seats near the back of the room. "Suddenly, I don't feel so much like a person going home. More like I am about to leave it."

I looked at her. I wanted to say something profound, something which would make *her* feel better for a change. Yet all I could manage was a weak, "Me too."

Curtis climbed up on the low stage. He was a small, wiry man with a bald patch contrasting against his heavy gray beard. "Are we all here?"

Someone guffawed. "Not for long!"

Curtis waited until the laughter died down. "No, friend, not for long." He looked around, his darting black eyes seeming to pick out every individual in turn. "I just want to make sure we are all ready for our—ah—rebirth into human society."

"Oh, come off it Curtis." Zoltan Genser, the commander of the Alpha expedition, squinted sourly at the man who had controlled our lives for thirty-six months. Zoltan was almost blind, the result of a lovely blue-green flower which had responded to his charmed curiosity with a spray of acid. He had not lost his command ability; indeed,

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

during our final five weeks on the planet we accomplished more than during the previous ten. Part of it, I know, had been because of his bursting impatience to return home so he could get new eyes. Now, after a further three years of waiting, his hostility came out in a belligerent: "You're not thinking of a further delay, are you? Because if you are, you can damn well forget it!"

There was no applause, although many of us sympathized. For various reasons we were all riding a delicate edge, and no one wanted to force what was already a palpable tension.

Curtis said mildly, "Actually Zoltan, I am considering no such thing. I am merely wondering whether or not we should continue the indoctrination sessions after we return to Earth. Now may I continue?"

He looked at us and we looked back. Superficially, I suppose we appeared a more or less normal collection of people—male and female, young and middle-aged, white, black, and a few shades in between. But we were also a highly intelligent group, which in a sense was his central problem. Intelligence goes with sensitivity, which meant many adjustments would be difficult. He knew it; we knew it. So Curtis had good reason to choose his words with care.

"I need hardly remind you that human beings begin to suffer psychological deterioration if they remain away from Earth for more than three years. For some it is a little longer than that length of time, for others not so much, although the variations seem limited to about 10 percent either way. So far, there are as many theories to explain the phenomenon as there are scientists working on it, although personally I suspect some kind of subtle relationship exists between man's physical environment and his mind—a link, if you will, which permits normal mental processes only when his senses indicate gravity, air, light, etcetera, are all Earth normal.

"Fortunately, those first three years can be tolerated with no noticeable ill effects. After that the symptoms appear quite rapidly, including irritability, tiredness, inability to concentrate, and so on. You know the score.

"So how long can the human personality remain separated from Earth without suffering a complete breakdown? Does the deterioration continue to an inevitable end, or does it stop after a time leaving the individual depleted but still functional? Is there even a reversal, a return to normalcy? Hell, you know the questions as much as I do. What we still do not have, are the answers. Until we do, the future of interstellar exploration must remain in the classification doubtful."

I wondered if I had heard correctly. *We're here, aren't we?* I wanted to shout. *Gerenson, Kraskinn, DeZantos, Scheckart, Genser and Burret; six answers giving you the stars on a plate. So why the doubts now?* With increasing irritation, I listened as Curtis continued.

"Since the Alpha expedition departed, another has been sent to Lalande 21185 and a third expedition to Epsilon Eridani. We do not know what *High Hopes* and *Frobisher* may or may not find, or even that they will return. But the success of the *Robert L. Cassion* and her crew does at least hold a slight hope that humankind has a future among the stars."

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

"Only a slight hope?" puzzledly queried Greg Su Yang, Eratosthenes's portly hydroponicist. "Curtis, I hope I do not need to remind you that we have six healthy individuals here who have already been to a star and back."

"The man's flogging a dead horse," someone muttered.

"You think so, Josie?" Curtis retorted, unerringly identifying our tiny, elfin-faced dietician. "Then let me ask you a question. Why haven't any of the alphanauts suffered the deterioration I was just discussing? They have, after all, already been away from Earth for considerably more than their alloted thirty-six months."

Josie Zenermann was not the lady to overlook a challenge. "Are you serious? You know better than anyone that their years in deepsleep do not count. Neither do the two years they spent on Alpha Five. Which, unless black is white and I am two meters tall, tells me the three years they have just spent in Eratosthenes puts them in the same boat as the rest of us!"

Curtis shot back through the ripple of laughter; "Based on the assumption that deepsleep somehow restores the psychological balance? That periods of activity between periods in deepsleep are not cumulative? Is that what you are implying?"

"Implying? Dammit Curtis, it's no implication, it's simple fact! You know it, we know it, the whole bloody world knows it. Would U.N.S.A.A. have sent the lads to Alpha if they suspected they might end up as raving lunatics—which they didn't?"

This time, the temptation to give in to our feelings was too much. We all cheered. Curtis waited patiently until he could be heard. Then, quietly;

"Of course not. Unfortunately, we now know that our previous assumptions about deepsleep are in error."

"I am going to show you," said Curtis Paoli, "the results of an experiment actually concluded some years ago. It was done in such secrecy, neither I nor any of my colleagues knew about it. And the results were so embarrassing to certain people, the security lid was clamped even tighter—until someone finally had the good sense to realize that in this case, security is a cure which is infinitely worse than the disease. In a further act of enlightenment, the information was finally transmitted to Eratosthenes—" Curtis coughed "—only yesterday."

No one commented, although somewhere behind me I heard a grumbled, "Wish he'd shut up and get on with it," followed by a female admonishment, "Hush."

The lights dimmed, and the screen at the front of the lounge illuminated with the image of a spacecraft settling on its tail amid a swirling cloud of brown dust. A crescent Earth was high in the black sky, so obviously this was somewhere on the Moon. A service crawler trundled into view, its boarding tube extended and two space-suited figures riding within the open end of the tube. This was so contrary to accepted safety standards, I realized we were viewing no ordinary arrival.

From the darkness at the side of the lounge, Curtis explained. "Although a commentary came with this tape, I will save time by giving you an abbreviated

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

version. First let me remind you that the so-called 'remission' aspect of deepsleep was assumed on the basis of a great deal of theoretical research which was independently corroborated by reputable people in labs all over the planet. Even so, it is undoubtedly true that more could have been done, especially on human subjects. But because time was limited and resources even more so, it was decided to trust the data we had and go ahead with the proposed Alpha Project. And later with two further missions to Lalande 21185 and Epsilon Eridani.

"But after the *Frobisher* departed for Epsilon Eridani, our political masters were finally persuaded to delay the proposed fourth interstellar project so that funds could be diverted to set up an actual test. It is that test, ladies and gentlemen, which this tape is all about."

The scene on the screen cut to a camera within the boarding tube. The tube had already been mated to the collar around the ship's airlock, and the two suited men were opening the lock using the hull emergency controls. Curtis continued,

"After working a standard three-year tour here on the moon, four volunteers—two married couples—were placed in deepsleep aboard this ship, appropriately named *Four Companions,* which under computer control was sent out to an orbit beyond Pluto. The computer then revived the four for what was to be their second consecutive tour away from Earth. They were isolated of course, as few human beings ever have been. But there was work to do, not to mention ample facilities for recreation. In theory they would end the test in no worse shape than they had been at the end of their Luna tour. In practice, however—"

After a moment's hesitation, Curtis added, "It was fortunate the ship's vital control and life support systems were concealed behind armored bulkheads.'

The reason for his comment was evident in the next few scenes. There was a shocked indrawing of breath as the lens of the camera revealed unbelievable shambles inside the *Four Companions.* Furniture was smashed to kindling, experimental apparatus wrecked beyond recognition, bulkheads bent and sometimes penetrated as if hit blindly and repeatedly by a madman with a club. Capping the insane parade of destruction was a partly decayed corpse in the ship's lounge, its smashed skull centered on a huge stain which was obviously long dried.

"He was not the only one," Curtis said, his voice carefully devoid of emotion. "A woman was found in the storage deck with a knife in her back, the second woman in one of the air locks. She apparently expired when she cracked the outer door without the protection of a suit. She was, in fact, as naked as the day she was born."

There was movement on the screen as the two men from the crawler reappeared supporting a shambling thing which hardly seemed human, although beneath the dirt and the hair there was a blank-eyed caricature of a human face.

The screen blanked and lights came on high.

"That man is now happily living in a group home. He is harmless now, his mental age somewhere around that of an eight-year-old child. He plays with toys, and he has invented an imaginary

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

play companion he calls Stella. In his former life, Stella was his wife. She was, incidentally, the lady in the air lock."

I had had enough. I was angry and I did not give a damn who knew it. I jumped to my feet. "As far as I am concerned, *Doctor* Paoli, your horror show does not mean a goddamn thing!" I pointed. "Look at Eric over there. Does he look sick? And what about one-armed, table tennis champion Victor Kraskinn? And chess master Gellan DeZantos? Right in front of you, is Howard Scheckart. That man may not talk much, but he knows more about the botany of two planets than any man alive. All right, so Zoltan cannot see too well right now, but he does not need eyes to be the smartest person in this room. Which leaves me. Right?" I struck an exaggerated pose and rolled my eyes. "I am not crazy, either!"

Deflated, hardly aware of the scattered applause which greeted my outburst, I collapsed back into my chair. Joan did not say anything, although there were tears in her eyes as she took my arm and hugged it.

Curtis sighed. He was tired and he looked it. "Richard, let me put it this way. From the start, the Alpha Project and those which followed were multi-million-dollar gambles. Although the twenty-meter orbital clearly indicated the existence of planets, there was no way we could tell if any of them were even remotely Earth-like. In fact, most people on the Project would have considered it a bull's-eye if the best you found was a world like Mars, for instance, where humans could at least survive inside a minimum duty pressure-dome. So what did you stumble on to? Alpha Five! With a breathable atmosphere, one-point-o-five gravity, and compatible food sources. Indeed, Alpha Five is so Earth-like, your biological systems were fooled into believing it *is* Earth! Hence your continuing rationality, even after a further three years here in Eratosthenes."

In a stage whisper we all heard the irrepressible Eric Gerenson chortled, "Now ain't that nice? We got no hang-ups!"

Curtis waited patiently for the laughter to subside. "Not necessarily, Eric. Do not forget you still face reintroduction into Earth society, which will be no picnic, I assure you. But I happen to believe we have prepared you well enough for that particular adjustment. And you can always remind yourself that if it was not for Alpha Five—"

Apparently disconcerted by an unpleasant thought, the scientist's face darkened. After a moment, he continued, "On the basis of what common sense tells me is the scarcity of Earth-like planets in the galaxy, plus the results of what Mr. Burret referred to as a horror show, I rather hope I will not be around when *High Hopes* gets back from Lalande 21185."

Excerpt from report by Curtis R. Paoli to the Executive Board of the United Nations Space and Aviation Authority:

Although the Four Companions *fiasco proves the fallacy of our previous conclusions about deepsleep, the success of the Alpha Five expedition is nevertheless heartening. Of course, this unexpected bonus only partially offsets the unpleasant fact that landings on non-*

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

Earth type planets must henceforth be limited to quick "look-ins" if, during subsequent quarantine, we are to avoid total personality disintegration of the crews. I suppose the necessity for quarantine can be avoided if we restrict future missions to close-orbit research, although I doubt that projects of such limited scope would justify their enormous expense.

Regarding the other two missions, I must remind you of the literally astronomical odds against either of them finding another Alpha Five. Therefore, to avoid repeats of the Four Companions *tragedy, I suggest the crews be returned to deepsleep as soon as possible after they return to the Solar System, and that they be kept in that suspended state until a solution is found.*

One final point. As you know, I am concerned about how the Alpha Five returnees will adjust to human society after an absence of half a century. Of particular delicacy is the problem of immediate relatives, and Richard Burret's is a classic case. When I had his daughter notified of his impending arrival . . .

The shuttle was larger and more luxurious than those I remembered from more primitive times. Powered reentry was a real advance, resulting in a ride which was amazingly smooth and G-tolerant. But I paid little attention to those refinements, as I stared with agonizing intensity at the meaningless shadows on the entertainment screen. Joan knew this was one battle I would have to fight alone, so she sensibly kept her concern about my state of mind to herself. Because I had often shown her the pictures of my daughter as I last saw her, Joan had understood my terrible sense of loss when I finally saw and spoke to Cheryl from Orbital Three.

Cheryl Burret Reed was now a middle-aged widow. She had lived most of her life while her father spent forty-four of the past forty-nine years in deepsleep between the stars. I had always known, of course, that changes must occur in my offspring over those years. She and I were, after all, experiencing a classic phenomenon of relativistic space travel. But for me that was a conscious awareness only, based on my knowledge that the calendar had not stopped turning merely because I happened to be in deepsleep. The traitor was my body, my glands and instincts. They *knew* the child of my flesh was only eleven; a gawky pre-adolescent version of the merry six-year-old who had asked for a star teddy.

"My god," I whispered when the graying lady with the maternal figure and kind smile had appeared on the screen. "She looks like my mother!"

To my everlasting shame, Cheryl had acquitted herself nobly, welcoming me with the happy chatter of someone meeting an old friend after years of separation. On the other hand, the words I managed to utter were pathetic and few, and in near panic I had finally broken off contact. Now, as the shuttle was knifing down through the troposphere towards touchdown, I began to sweat at the thought of what was to come.

"It's all right," Joan whispered, sensing my distress. She lifted my hand and kissed it. "I will remain with you. I promise."

It was trite, and I don't know if at

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

that moment she even meant it, but she had said the right thing. Somehow I found the strength to repress the self-pity, and with an additional effort of will I told myself I was returning *home*.

If first contact with my daughter had been difficult, the welcoming ceremony was almost as bad. Fortunately it was brief. Nevertheless, the overwhelming noise and presence of tens of thousands of people behind the security barriers, was nerve-wracking. When a V-formation of hypersonics roared overhead in salute, I almost jumped out of my skin. We lined up nervously as the president of the United Nations shook our hands and presented each of us with the U.N. award for meritorious service. The thunderous roar of approval as we approached the presidential plane caused us to scramble up the ramp like shy animals seeking cover.

Joan came with me to a cabin at the rear of the aircraft, where Cheryl was waiting to greet me in person. Joan watched quietly and with concern as two strangers, linked by the closest ties of blood yet separated by nearly half a century, tried to react to each other as society would expect.

I forced myself to embrace the lady. Then I presented my model of a star teddy. It was gray and fluffy, had a sharp little snout, six legs, and two enormous multi-faceted eyes. Praying it had plausibility, I asked awkwardly, "Do you remember when you asked for this? Well here is your star teddy."

To my astonishment, Mrs. Reed was delighted. She held the doll by its forelimbs and exclaimed happily, "Of course I remember! I even remember no one could convince me you weren't going to bring me one that Christmas. I can hardly wait to show it to my grandchildren!"

"Your—?" Completely astonished, I stared at her. "You mean I am a—" I swallowed. "—a great grandfather?"

She looked at me with surprise. "Two little boys and a girl. Didn't they tell you?"

"Oh god no," I said violently. Helplessly I turned to Joan, who returned my unspoken plea for help with a small shake of the head. She felt for me, though. I could tell that. I turned back to Mrs. Reed. "I guess they figured to ease me into it. I mean—" On impulse, I grabbed her shoulders. "Dammit, do I look like a great-grandfather?"

She studied me, at first seriously and then with a dawning bewilderment. The incongruity had finally caught up with her. "You look more like my—" She bit her lip. "—my younger brother, if I had one!"

I wondered desperately, *Will I ever be able to look that dear lady in the face and call her Cheryl? Or even 'daughter'?* Our relationship was ludicrous; now she knew it as well as I.

Yet somehow, as if by unspoken agreement, we adopted the simple expedient of talking to each other without the use of either name or title, although when the three of us joined the others in the main cabin, it became convenient before third parties to refer to "Mrs. Reed," and "my father." (Already, to my discomforture, my daughter was beginning to accept the unacceptable.) In the misery-loves-company context, I was ridiculously pleased to notice that at least some of my colleagues were having their own adjustment problems.

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

Eric and Gellan, for instance, who had never made any secret of their homosexual relationship, were sitting together across the aisle from us. Each was staring stonily ahead as if the other did not exist. A couple of rows ahead, I heard Howard snap irritably, "I paint. So what? I don't want to talk about it!" A deeper voice responded, "I guess that is your privilege, Mr. Scheckart." The president then stood up and walked toward his private suite at the front of the aircraft.

"Well I'm damned," my daughter marveled. Placing a plump hand on my shoulder, she whispered conspiratorially in my ear, "I voted against him, you know."

I did not think it was particularly funny. Yet her mischievousness was so ingratiating, I had to smile. "It does not surprise me. You always were a rebel."

Joan said anxiously, "Richard, I hope you are not planning to talk to the president that way."

I squeezed her hand. "No way. I'm chicken."

Fortunately that august personage did not test my resolve to stay out of trouble, as for the rest of the flight he stayed prudently out of sight. He did not appear even as we left the plane in Geneva and were promptly driven to our quarters in the sprawling U.N. complex. There was time for a brief rest, to clean up and dress, and then we were the guests at a banquet given by the leaders of the house of assembly.

It was a strained and rather strange affair in which the six of us were seated at the head table along with the president, the speaker of the house, the director of U.N.S.A.A., Curtis Paoli, and an elderly Vietnamese who was the senior spokesman for what was still referred to as the "Third Block." We played with our food and, as the proceedings dragged on, tried to maintain control over our various frustrations. I looked for Joan and Mrs. Reed among the hundreds of guests, finally spotted them at a table toward the back of the room. Aware I was looking in her direction, Joan blew me a quick kiss. Then Zoltan got up to speak. I lowered my head and with the edge of my fork drew nervous circles on the tablecloth while he restricted his speech to a few forgettable banalities. At least Zoltan did not embarrass us. When he finished, he dropped back into his seat like a limp rag, turned to me and remarked—obviously not caring who overheard, "Hopefully, that'll shut 'em up for a while." The speaker, who was sitting on the other side of me, flushed angrily. U.N.S.A.A.'s director merely smiled. Finally, Curtis rose to begin the main speech of the evening.

He had already outlined to us what he was going to say (which was not much), so I only half heard the drone of his voice while I thought of nothing in particular and continued my excavation of the tablecloth. I hardly noticed the marine who cat-footed behind us and stooped to whisper a message to the elderly Vietnamese. The message concerned, as it later turned out, a matter whose importance had been inflated by an over-zealous aid. But as the marine leaned between the diplomat and Howard Scheckart, he inadvertantly knocked over a carafe of water which spilled its contents onto Howard's lap. Before the embarrassed messenger could apolo-

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

gize, Howard viciously jabbed an elbow back into the leaning man's midriff. "You clumsy bastard!" he screamed, as with maniacal rage he leaped out of his chair and flung himself on the gasping marine.

Shocked out of my moody introspection, I stared astonished as someone shouted, "Grab him!" Two burly guards sprinted over, hauled the screaming botanist off his victim and hustled him out through a side door.

Got to do something, was my instinctive reaction as I pushed my chair back. Joan was shouting my name as she ran among the tables toward me, but I did not hear her as I caught up with Curtis and the others and fought my way through the confusion to the door.

A fast-moving medic had already got to Howard by the time we caught up with him and the guards in the adjoining lobby. Reacting to the drug the medic had just pumped into him, Howard barely had enough strength to lift his head and mumble, "Sorry," before he sagged limply into the arms of his expressionless captors.

"Put him on that couch, please," Curtis ordered. He asked the medic, "What did you give him?"

"Kirol B," The medic replied as he snapped his case shut. "It's harmless. He will be out of it in about four hours."

"He had better be," Curtis said grimly. He looked around. "Does anyone know how the other fellow came out of this?"

"I'm all right, sir," the marine called in a hoarse voice. He pushed his way through the crowd, his face anxious. "How is Mr. Scheckart?"

Curtis patted the marine's arm. "Considering what was almost done to you, young man, I appreciate your concern. Anyway, I am sure he will be OK." Curtis turned to the medic. "Have Mr. Scheckart taken up to my suite, please. I will be there directly."

"Of course, Dr. Paoli."

As the medic led the two guards and their unconscious burden toward the elevators, I asked, "What about the rest of us, Curtis? Something tells me we need to talk about this."

"Agreed." Curtis picked us out in turn from the couple of dozen people who had crowded out of the banquet hall. "Eric, Victor, Gellan, Zoltan, Richard—all of you. In my suite in thirty minutes." Someone pressed through the crowd to my side. "Joan? You too, please." Curtis hurried away.

Joan pulled me aside. "You look awful," she said anxiously.

"I feel like hell. Where is Mrs. . . . my daughter?"

"You will see her later. Richard, something is terribly wrong—not just with Howard, but with all of you."

Something? One way of putting it, I thought bitterly. Someone began to laugh, a cold laugh, without humor. It was only as Joan retreated from me, her eyes wide with hurt surprise, that I realized the laughter was my own.

Slightly less than two months later, Zoltan Genser killed himself. The circumstances were described in a further report from Curtis Paoli to U.N.S.A.A.'s executive board.

. . . which is a complication I certainly had not anticipated, and which has required me, again, to revise my thinking about the future of the inter-

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

stellar program. There is still a price, of course, and the tragedy of Zoltan Genser is that he paid that price with his life. But in the long run, I am convinced that man will evolve to heights undreamed of on this small planet. It is as if nature herself took a hand, when she implanted within every individual a kind of evolutionary "trigger" which can only be released once. But which, once released, forces that individual to become a creature of the cosmos.

You know of course that Dr. Genser chose to remain behind because of his desire to have full vision restored. He was aware of the risks, and agreed to become a test subject for our team of psychologists. But as I witnessed the deterioration of that strong personality, even the success of the eye transplants having little effect on his downward slide, I confess I found it increasingly difficult to maintain any kind of scientific objectivity.

The desperation of Dr. Genser's condition is perhaps best illustrated by the fact he was quite aware the operation had been a success, and that within weeks he could join the others on Luna. His private hell was too much for him however, causing him to commit the act which for him was the only possible cure.

The good news is that the refit of the Robert L. Cassion *is proceeding on schedule, and the ship will shortly be moved to luna orbit to embark the colonists. They are in good spirits and have raised no objections to their cramped quarters. It is unfortunate that deep-sleep equipment for three extra persons takes up so much space, which is why the crowding is unavoidable.*

Regarding the selection of personnel for the Amazon Project, I am aware that female candidates do not, as it were, "grow on trees." So I suggest we take the appropriate steps to set up an intensive selection and training program. . . .

When I spoke to Cheryl for the last time, it was the day before the *Robert L.* was to depart from luna orbit. It still seems strange to me that as those final days on Earth became even more unbearable, my relationship with my daughter progressed from awkwardness to friendship, and finally to love. Despite her years, Cheryl *was* the child I had fathered and to whom I had promised a star teddy, and my final acceptance of that fundamental truth was the calm within my personal storm. It was during those wonderful yet sadly brief few hours, while I was rediscovering my fatherhood, that I wondered aloud if as a bonus I could meet my three great-grandchildren. But Joan had been keeping close tabs on the progression within me of the Earth allergy syndrome or "E.A.S," and firmly scotched that idea. Too risky, she insisted. For the children, as well as for me. I did speak to the youngsters on viewphone, but that was hardly the same—especially when I realized the remarkable physical resemblance of seven-year-old Christine to my own six-year-old Cheryl. Christine had been the tongue-tied one, with a shy "Have an nice trip, great grandfather" being the total sum of her words. But I have the tape, and will see and hear her say it many times before I die.

Cheryl was kind. She had regained

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

her lost father, she told me, and was content. Although I did not quite understand the logic of that, I told her I was happy she had accepted the situation. I also told her I would never forget her. In themselves, I suppose those words and the others we exchanged over a quarter of a million miles, although true, did not say a lot. Then again, they did not have to. Father and daughter had made their peace with each other, and there would always be the memories.

She will die of old age while I am in deepsleep. When I die, her bones will have already turned to dust. But that is the new way of mankind; the old way of the Universe.

Launch minus two hours and fifteen minutes.

Captain Gellan DeZantos, Eric Gerenson, and the other three male members of the crew and their wives, sat before the screen in a view room of the Clavius Base. From the screen, the image of Curtis Paoli looked wistfully down at us.

"I had wanted to be on Luna when this moment came," the former Eratosthenes adminstrator confessed. "Unfortunately, the agency ruled otherwise."

"A ruling based on your own recommendations, Curtis," Gellan pointed out. "After all, you have put in your three years. Now you have to be satisfied with terra firma."

Curtis smiled. "True. But at least I know where I belong. You people, on the other hand, will be like children in a candy store. With the whole Universe to choose from, which goody will you head for next?"

Which indeed? It was a profoundly loaded question. Undoubtedly Alpha Five could not hold us forever, especially as more ships became available. Earth-like or not, with or without pressure domes, all worlds—except one—had become grist for the starman's mill.

Beside me, Joan stirred. "I feel—" She hesitated. "Oh, I don't know. Strange, I think."

The image on the screen cocked a quizzical eyebrow. "Will 'mixed up' do?"

"I know I will never see Earth again." Joan twisted her hands together nervously.

"It is not too late, you know," Curtis said. "Isn't that right, Richard?"

I had known it was coming, but it did not make it any easier. Turning to my bride of less than a week, I took both of her hands in mine. As I did so, I prayed I was not giving out enough rope to hang myself. "You heard the man. What do you want to do?"

She forced a smile. "Sorry, dear. You will not get rid of me that easily."

Thank you, God.

From his office in one of Earth's great universities, Curtis nodded approvingly. "Joan, have you sensed any symptoms yet?"

"I feel tired," she admitted.

"Which is to be expected. Anything else?"

Joan thought a moment, then shook her head. "I don't think so."

Curtis looked relieved. "I am glad to hear that. For a three-year-plus, you are not doing so badly. And you will be in deepsleep in a few hours, so you can look forward to snoozing the years away until you get to Alpha Five."

"Genser's World," Howard Scheck-

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

art corrected. He turned to the woman at his side. "Right?"

"Right," she echoed. More than anyone, Doctor Evanne Stiegler had been responsible for Howard's recovery from his bout of schizophrenic violence. She was the reason he was no longer the moody, introspective character he used to be—and with this talented life partner at his side, it was doubtful we would ever see the old Howard again. Also, as the expedition's medical doctor, Evanne was fully qualified (as she wickedly reminded us after her appointment was confirmed), to "birth babies."

Howard said, "We all agreed the new name is appropriate." He added earnestly, "You will get the agency to confirm it, won't you?"

Curtis nodded thoughtfully. "Genser's World, huh?" He seemed pleased. "I will suggest it to the board when I meet with them in a couple of days."

"Do more than just suggest it," Victor said. "*Tell* them. Because if any one needs to reach us, that will be our address."

The man who for three years had protected us from ourselves and each other, smiled. There was a fatigue, an extreme weariness in his manner I had not noticed before. There were good reasons for that of course, and I sympathized; we all did. It was only because of Curtis's herculean efforts that the scientific and then the political bureaucracy had finally understood the incredible ramifications of what had happened, and had approved the necessary resources to continue what nature had apparently started.

Question. How had the alphanauts gotten that way? What mysterious mechanism made Earth reject us so thoroughly? Would Genser's World also reject us if our subjective time away from that planet exceeded some innate value? After all, Curtis had already theorized that we had survived five years away from Earth—two on Genser's World and three on the Moon — because our body clocks had assumed Genser's World was Earth, and had therefore not counted the two years we spent on its surface. It was a good argument, except for one flaw—our clocks had performed a remarkable about-face and no longer recognized the world of our birth as a benign environment. What had happened to Zoltan, to Howard, and to a lesser extent to the rest of us, was clear indication that the remorseless ticking had continued even after we arrived on Earth. So what on Genser's World had switched us from one ecological system to another? It was biochemist Melba Kraskinn's assignment to find out, along with her team of Joan Burret and Evanne Stiegler.

Whatever was accomplished, whatever discoveries were made on Genser's or any other world anywhere in the galaxy, the women would be as much a part of it as the men. They were special people who would surely redefine the role of their sex, and why not? Earth's archaic social customs would have little meaning on a world which had already made us aliens on our home planet. Then I thought of Eric and Gellan, and again, why not? They were good men and our good friends, which is as much as anyone can ask or should expect.

I projected my imagination a few thousand years into the future, and saw

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

our descendants much as we were; men and women who were still accomplishing, still exploring. Their only difference from us which, as I thought about it was really not so important, would be that most of them will probably have never heard of a place called Earth.

The crew of the Frobisher *had not found any habitable planets around Epsilon Eridani. But the fourth planet's strange life forms, existing in near vacuum, had occupied the science teams for twenty-two fascinating months. Finally, expecting eventual revival among the familiar worlds of Sol, they reentered deepsleep aboard their ship. They did not know of the signals which revised the preset course settings even as the* Frobisher *accelerated along the long spiral which led toward interstellar space and home.*

The High Hopes *was already on its way but still more than four lights from Earth, when its detectors intercepted the signals. Although there was not nearly enough delta V available for such an extensive course correction, there was a brown dwarf almost in the direct line of flight. The artificial intelligence which was the brain of the ship examined the data, ruminated for a few milli-seconds, and finally decided a gravity assist was possible. The ship was rolled, slightly realigned, megawatts of fusion power pumped into the main drive.*

High Hopes *was also on its way to Alpha Centauri.*

While at about the same time, another starship, Amazon One, *was bearing its sleeping complement toward their rendezvous with the men of Genser's World.*

Homo interstellar *was in the process of being born.* ■

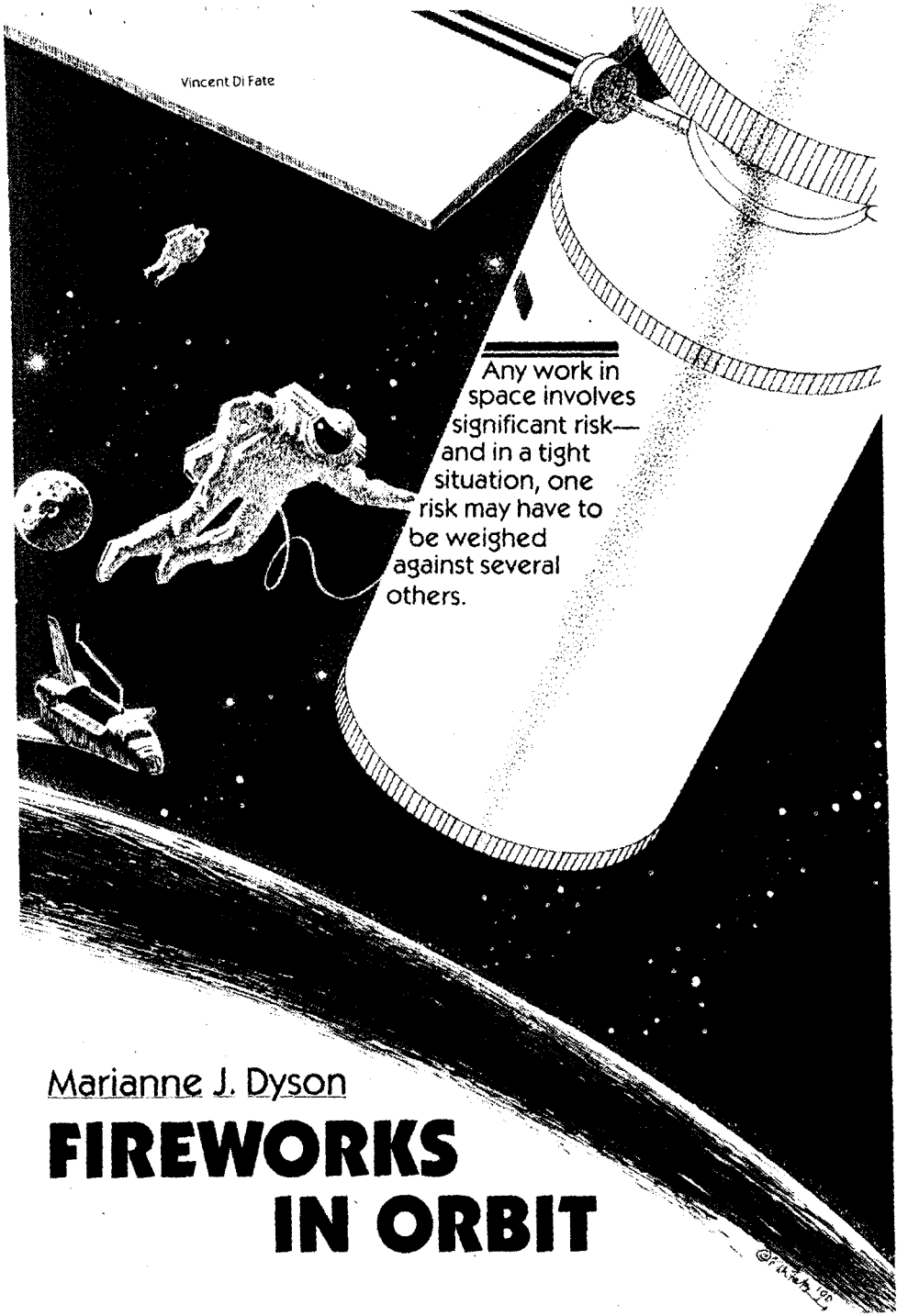
IN TIMES TO COME

● If you've been reading *Analog* regularly for a while, you've already met the Nomads, in W. R. Thompson's stories "Maverick" and "Varmint." (If you haven't, don't worry about it.) The ancient, deep-space-dwelling aliens wield enormous power for reasons that remain mysterious despite the fragmentary clues they've left in vaults on scattered planets, requiring interspecies cooperation to decipher them. In *Outlaw,* the two-part serial beginning in our September issue, the Nomads's influence moves quite close to home: they have a job for humans to do, and they won't take "no" for an answer. Nor will they explain the purpose of the thing they want built—but it's uncomfortably clear to the drafted builders that a side effect of its use could be the destruction of life on Earth. Why would anybody take such a job? Because the alternative is *certain* destruction. Which puts everybody in a *very* ticklish position!

Of course, it's hard enough to figure out *one* set of alien motivations. When there are two or more, themselves in conflict, it gets even trickier . . .

Dr. J. Kevin Steele is back with another fact article, this one about another multifactioned alien enemy that works, right now, in a completely different kind of space. "Cancer" is a catchall for a great many separate diseases, and the mechanisms that cause them are far more complicated than for many other ailments. Yet several lines of recent research suggest that there may well be methods of combatting them that will work across the whole spectrum of cancers.

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED


Vincent Di Fate
Any work in space involves significant risk— and in a tight situation, one risk may have to be weighed against several others.

Marianne J. Dyson

FIREWORKS IN ORBIT

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

Ever since he'd been a kid, Ben Cooke had dreamed of this moment, floating free in space, a one-man satellite in the heavens. Like a truly great movie, it was even richer the second time around. His wife had asked him to detail the sensations so she could describe it in a story she was writing. Ben felt that even a poet laureate could not fulfill such an assignment. Certainly a middle-aged balding man who was more interested in physics than football would not stand a chance. "The view is really neat," he said to his commander, Trap MacArthur, who was monitoring him from inside the Orbiter.

"Roger that," Trap replied simply. He must have realized Ben's need for a peaceful moment of reflection because he didn't follow with more of Houston's constant chatter of instructions and corrections. When he got back, Ben decided he would thank the system engineer who had designed EVA communications so that the ground could hear him, but he couldn't hear them.

He saw his EVA partner flying toward him like a gently tossed pillow. "You're looking good, Dale," Ben said. Dale appeared as at ease in a vacuum as he was quiet and content in the simulators. The well-muscled blonde had earned the nickname Saint Bernard because of his ability to plow through mountainous snowdrifts of paperwork to uncover hidden technical problems. All his efforts had paid off when he was the first of his class to be selected for a mission. Even though Dale's helmet visor acted like a mirror, Ben knew he was grinning ear to ear.

"You know, Ben, my wife got it right when she put that bumper sticker on our truck. The one that says, 'I'd rather be orbiting'!" Dale said.

"That's for sure," Ben replied, smiling at the thought of his wife interrogating Dale after the flight. He had a feeling she wouldn't get a poetic description of EVA out of him either. "Unfortunately, we've got work to do."

Even though he had done an EVA before, and he and Dale had been training for an EVA on this mission, the addition of the Air Force satellite control unit repair had taken him by surprise a month ago. The flight planners had been forced to schedule the EVA on the second flight day since the rest of the timeline was already crowded with carefully approved objectives. Usually EVAs were not scheduled until later in the flight to insure that space sickness didn't interfere. But their other EVA, which involved checkout of new space station hardware coordinated with the international partners, could not be rescheduled from Flight Day Four without major political embarrassment, and back-to-back EVAs were considered too exhausting. At least Dale was one of the 50 percent of astronauts who adapted to zero gravity without turning green.

Still, the Eagle Scout in Ben felt minimally prepared to perform the task ahead. Maybe it was a touch of nausea that was making him feel uneasy, or maybe it was the sight of the dangerous chemical laser on the satellite. If the hydrogen and fluorine canisters were punctured so that the gases mixed, the resulting fireworks would most likely kill Ben and Dale. Despite the risk to

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

the crew, the last-minute addition to their existing flight had been approved all the way up the chain of command due to "National Security Implications" if the satellite were not available. Trap had felt they could handle it. The vice-president had personally seen to it that a mock-up was expeditiously provided to NASA for water immersion training. Sometimes the National Space Council did something useful. It wasn't the vice-president's fault, that due to security and crew safety regulations, training hadn't started until the week before launch. Ben knew this would be a merit badge hard earned.

He could see tropical storm Geraldine out in the Pacific. He doubted the photos would show the depth of that cloud mass as seen from orbit. To not look at it and concentrate on the task at hand was like choosing to read a dissertation on the importance of calculating the billionth digit of pi while looking at a nude Miss America. Ben sighed as he tore his eyes away from the lady Earth and carefully adjusted his trajectory to the satellite, now reflecting the full sunlight as they sailed toward the noon zenith.

He was using an approach commonly called "shooting the v-bar." That meant he would alter his velocity relative to the satellite like two cars matching speeds on a race track, and then he'd attach himself to the satellite with a grapple fixture mounted on the front of his suit. The whole procedure reminded him of an old TV commercial where two limousines came side to side and the one guy asks if the other has any fancy mustard. When he'd mentioned this analogy to one of the training guys, a jar of the stuff had shown up on a checkered tablecloth in one of the simulations. But there was no mistaking the grapple fixture for a jar of mustard. If anything, it looked like a toilet plunger. Its purpose was to provide an attachment for the remote manipulator system, commonly called the arm.

Ben could just see Curtis looking out the orbiter's overhead window. Ben thought the typical fighter jet pilot was probably in seventh heaven right now because he was flying the *Voyager* by looking out the window, even though the display was there if he needed it. Ben knew he and Trap would stake their reputations on their ability to maintain a fixed position relative to Ben and Dale, even while circling the Earth every ninety minutes. Curtis began a steady countdown of Ben and the satellite's relative velocity and closing rates. He appreciated his disk-jockey voice. Unlike his dealings with the ladies, the hot-blooded redhead was strictly business now.

With the backpack jets, Ben increased his velocity until he was in the slightly lower orbit of the satellite. Dale maintained an orbit slightly slower and higher than Ben's. Once Ben had arrested the satellite's slow spin, Dale would join him. The sunlit side of Earth was continuing to whisk by below. He and Dale had thirty minutes of Earthshine left before they entered the thirty-minute night of their orbit. Even with the payload bay lights, they wouldn't attempt a satellite capture during the night portion of the orbit. It was amazing how easy it was to lose something fifteen feet wide and some thirty feet long against the total blackness of outer space.

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

Curtis reported he was "on the money." That meant he had matched rates with the satellite and was go to shoot the target. He waited for one solar panel to spin by, then flew at the satellite with the plunger held firmly before him. "Contact."

"Contact confirmed," Curtis acknowledged.

"Good shot!" Trap added.

Ben's jets were firing to counter the satellite's spin. The Earth gradually assumed a steady position under his feet and the orbiter one over his head. There was no more spin.

"Can I get on the merry-go-round now?" Dale asked with a twinkle in his voice.

"All aboard!" Ben replied. From the orbiter's direction, Ben watched as Dale appeared to grow larger. With no horizon for reference, judging distance could be tricky in space. Once again he appreciated Curtis counting down the separation distance from his plot inside.

Soon Dale attached himself to the opposite side of the satellite. With both of their thrusters full throttle on the backpacks, they would maneuver the satellite into reach of the orbiter's arm, like two guys pushing a dead car off of the freeway.

"Ready or not, here we come!" Ben panted. He hadn't realized he'd been holding his breath. He felt his thin brown hair sticking to his forehead. Even with the suit fan going full tilt, he was sweating in the EVA suit. He imagined the Flight Surgeon's eyebrows lifting when he noted on his display in Mission Control that Ben's heart rate had gone over sixty for the first time in history. Ben could blame the sweating on his Eskimo build, but he knew his heart rate was a giveaway of the pure thrill he was experiencing.

Forty-five minutes into the EVA, Ben heard the sing-song voice of Carolyn Hunter, whom Ben's wife called the rich snob. Despite his wife's judgment of Carolyn, she was the best arm operator in the astronaut corps. Soon after reaching orbit yesterday, she had used the arm to deploy a space station test article that would be retrieved on a later flight. Ben had watched her control the sixty-foot robot arm with the same ease which his grandmother handled a knitting needle. Ben could overlook personality when it came to competence. Besides, no one would disagree that she was the best-looking member of the crew.

Carolyn was calling out relative separation of the arm's end effector and the newly attached grapple fixture on the satellite. "Ten feet, eight feet. Steady. A little to the port." Ben was on the arm side of the satellite and Dale was on the Earth side. This pushing and pulling of the satellite into position was extra tedious because he and Dale could not see each other. "Still not on the centerline. . . ." A miniature lightning bolt flashed next to Ben's helmet as the satellite grounded itself on the arm. He automatically let go of the satellite momentarily as Dale continued pushing.

"Hold it!" Carolyn shouted, but the satellite continued its slow movement toward the stalled end effector. The electrostatic discharge must have damaged the arm. Ben realized in the instant before impact that the now rigid arm would not stop the steamroller-sized satellite from crashing into the payload bay. Things were weightless in space,

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

but they carried the full force of their mass and acceleration. Ben was between the satellite and the arm which loomed like a lance waiting to strike—"The canisters! It's going to strike the canisters!" Ben shouted. Self-preservation instinct took over and Ben fired his backpack jets to get out of the way. In the vacuum of space, he didn't hear the silent explosion of the hydrogen and fluorine. Instead he heard Carolyn's voice crying,

"Dale! Oh God."

Ben didn't stop his jets until he was practically standing on the nose of *Voyager*. He hugged the orbiter as debris tumbled noiselessly over his head. One of the larger pieces contained a mirrored faceplate.

"Ben, where are you? Ben, report!" Trap demanded.

Hearing his name and the familiar voice of his commander brought Ben out of the automatic efforts to slow his very audible breathing and reduce his heart rate. "I'm safe. On the nose. Can I go after Dale?"

"No," Trap commanded. "Stay where you are, Carolyn is going to jettison the arm. As soon as it's clear, I want you in the airlock. Copy?"

Although Ben was no stranger to emergencies, having been a paramedic for years, the combination of space sickness and the sight of seeing pieces of a friend you've been training with for a year was enough to turn his gut inside out. After he unceremoniously vomited in his spacesuit, he responded with, "Copy."

"Ben, Surgeon says to drink some water. They're worried about shock."

"Roger," Ben replied as he dutifully swallowed a sip of lukewarm water, wishing the suit filter could get the smell of vomit out faster.

"Ben," Carolyn stammered. Her voice had that quiver like his six-year-old girl's when she was about to burst into tears. Ben could imagine the instant replays going over in her mind. "Stay where you are. I'm jettisoning the arm now."

Ben thought the word "now" had that final sound to it. Like when his childhood cat had been hit by a car and suffered for two long hours before dying, and his mother had said, "It's over now." He saw the arm spiral away, a stick for the Saint Bernard, both swallowed by the unforgiving blackness.

"I saw the arm. Is it safe for me to return to the airlock?"

"Yes. But there are large pieces of debris in the bay," Carolyn said. "Be careful coming back." Did she know those were the same words his wife, Anne, had used when she kissed him goodbye at the pad?

"I will." He pictured Dale's beautiful Swedish wife, face red and puffy, sobbing in the viewing room in Mission Control. Would she understand that Dale had dedicated his life to space exploration? Was becoming a hero ever worth it to the family left behind? He hoped his wife was there to comfort her. Being a writer, she usually found the right words, though he doubted there were any. At least there hadn't been any realtime TV of the accident. The press hadn't even been told there was an EVA on Flight Day Two, though some had speculated a repair as the reason for the last minute classification of the flight plan.

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

"We'll be heading home as soon as we get you inside," Carolyn said. Ben could hear the clang of the Master Alarm klaxons in the background. That meant the satellite had caused significant damage to *Voyager*. As if loss of a crewman weren't enough. He could picture the CRT displays covered with fault messages, Curtis scrambling to acknowledge each cascading failure while Trap reconfigured systems as quickly as Mission Control could voice up the procedures.

"I'm on my way." Ben slowly crawled to the bulkhead, grabbed a handhold, and climbed past the aft window where Carolyn was floating. He stopped at the work station near the airlock hatch to unload his tools.

"Hang on Ben, I'm putting us in free drift," Trap reported. Ben knew that shutting down the engines was part of several different powerdowns. He wondered which one they were using. The Earth would slowly drift away from its overhead position as the *Voyager*'s tail swung toward Earth in what was called a gravity gradient attitude.

"Carolyn, how long until payload bay door closing?" Ben asked from the airlock hatchway.

"Standby." That meant she was busy. Probably doing his part of the powerdown. The sense of wonder he'd experienced earlier was replaced with a longing to be inside with his crewmates, helping prepare for emergency deorbit. The power-hungry floodlights in the bay flicked off. "I just stowed the radiators. I'm initiating auto door closing now."

Ben watched as the port door eclipsed the stars and the setting Earth. *Somewhere out there is Dale.* The door stopped as it reached centerline.

"The starboard door is closing now," Carolyn said.

But Ben could still see Earthglow. "Ben," Carolyn almost whispered. "I'm not getting ready-to-latch indications."

"I'll go check for a jam."

"Hurry, Ben. We're getting 'Freon Flow Low' messages. Trap thinks the loops running through the rear radiators were cut by shrapnel. Mission Control says without Freon cooling, the fuel cells will flood in about an hour."

Ben remembered a training session on the loss of two Freon loops. The simulator had crashed. They had never determined if it was because the procedures were wrong, the models not sophisticated enough, or because he'd messed up something. Everyone said it was not a survivable case anyway. The whole procedure assumed that a continuous purge of the fuel cells would stall them from overheating long enough to get you to the ground. If they overheated, or flooded in their own byproduct water, the orbiter was left with no power source. No computers. No control surfaces. Dead. Buried in space, like Dale. The Saint Bernard smothered in a drift of white debris. He had asked to repeat the session, but with only two simulators, over one hundred astronauts to train, and the Air Force adding last minute "nominal" procedures, he'd never had the chance.

While Ben reloaded his tool belt for the door check, he was suddenly angry at the Air Force, his own management, and himself for expecting him and Dale to do a repair with only one week's training. What kind of arrogant bastards

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

were they anyway? He imagined some federal judge pronouncing the death sentence on the lot of them. Then in full public ceremony, marching them into the vacuum chamber at Johnson where the air would slowly be pumped out. Caught up in the image, he shuddered in his suit at the sudden onset of total darkness in the bay as they passed into the night side of the orbit. Then his headset startled him with a warning tone.

"Shit!"

"What is it Ben?" Carolyn asked.

Ben fumbled to acknowledge the tone using the display switch. When he could hear again, he said, "I've got a 'Suit Pressure Low' message. Must have been some damage to the backpack." He knew the secondary system would automatically kick in if the pressure dropped much, but it was only good for thirty minutes. Not long enough to fix the door.

"Mission Control says to check the O_2 actuator position," Carolyn said.

The switch was on the lower front of his suit. He had trouble feeling it through the gloves, but easily rocked it to the proper position. "That's what is was. Must have bumped it crawling over the nose. Tell those guys thanks for me." Even though he was slightly embarrassed for adding needless worry to a tense situation, it was comforting to know the folks on the ground were busy anticipating his every need. Ben's helmet lights pushed back enough of the gloom for him to finish attaching himself to a tether.

"Mission Control says to check for a door jam in the rotary actuator. You'll have to disable the one closest to the point of deformation."

It was not an easy task in the dark, but Ben worked with a feverish will to disable the actuator. This was a task he'd been well trained to do. He wouldn't let the rest of the crew down this time. By the time Ben was through, Trap reported he was five minutes from deorbit burn and had reactivated the jets to get into the proper tail first attitude. Ben wondered what landing site they were headed for. Probably Kennedy, considering it was only the morning of Flight Day Two and orbital dynamics hadn't lined them up with Edwards yet. "We're going to delay the burn until you are in the airlock," Carolyn told Ben.

"Tell Trap I'll hold on, go ahead with the burn!"

"He can't, Ben. Curtis is using the only computer to shut the starboard door." They had turned off all but one computer to save power.

"The door's closed, Ben. You did a good job," Curtis said. If Ben's repair hadn't worked, they would have burned up during entry. Ben sighed in relief. "We can delay burn ignition up to seven minutes. Trap wants to know as soon as you're buttoned up." Ben was already latching the hatch door.

"I'm in," he reported. He was almost instantly pressed toward the tail as the engines sustained about two minutes of thrusting. Ben's headlamps were pressed against the airlock viewport during the burn. The light reflected back was divided into two segments. There was a crack in the viewport.

"Carolyn will be down to help you as soon as she's done marking up the entry procedures," Curtis said. Ben de-

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

cided not to tell them about the crack just yet. He had little hope of Mission Control bailing him out this time. And if they messed up the entry procedures, none of them would see home again. In a mixed-up powerdown case, all the nominal time cues would have to be adjusted, and equipment that was turned off would have to be deleted from the procedures. The silence on the loop was deafening. For once he wished he could hear Mission Control.

"How long until entry interface?" Ben requested.

"Twenty minutes," Curtis replied.

Since they had delayed execution of the burn, the time between ignition and the point where they entered the atmosphere, called freefall time, had been shortened. If he tried to repressurize the airlock while they were still in vacuum, the window might burst, creating a gigantic hole. The air would be sucked to space, putting an additional burden on equipment that had already lost its Freon heat sink and depended on air for cooling. No, he couldn't risk it. He would have to wait at least twenty minutes to see if the pressure of the atmosphere would implode the window into the airlock. If not, then he could safely repress the airlock, but it would be too late for him to reenter the mid-deck by then. Although an old veteran had proved that it was possible to stand during entry, he doubted he could open and close an airlock with a four-hundred-pound suit on. He'd be better off to stay put.

He checked his air supply and battery power. He had used less than three of the available seven-hour capability provided and he'd be on the ground in less than fifty minutes. "Trap, this is Ben. I'm not coming inside."

"Why not?" His voice sounded tired.

"There's a crack in the viewport. Don't worry, I'll be OK. I've got plenty of air and battery power."

There was a moment of silence. "Ben, we've powered off communications with Mission Control. You want me to call them on this?"

"No. I think I'll be OK. This suit should be able to handle the heat load." *Just don't blow up any lasers near me,* he added mentally.

"OK, Ben. Give me a heads up if you wanna try the repress after EI."

"I will."

It was totally dark in the airlock, except for Ben's helmet lights. He imagined those lights reflected in Dale's faceplate. Was it only an hour ago? He should have thought about the satellite building up a charge. It had happened to lots of satellites. Sometimes they discharged from one side to the other in arcs as they went into eclipse. And there was that arm, sticking out there like a lightning rod. How could he have overlooked it? He knew no one would be blaming him. They would say, and rightly so, that if more time had been available, someone would have thought of it. But he still felt responsible. He should have thought of it. It should have been him left up there instead of Dale.

The orbiter vibrated gently, and Ben felt himself sinking to the floor of the airlock. The soles of his feet touched the bottom of his suit. They were in the atmosphere.

To further reduce the time from entry interface to the ground, they would be doing a steep entry. It would also reduce

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

the heating of *Voyager* since they would encounter the atmosphere for less time. Ben imagined the orange glow around the front windows. There wasn't any glow at his window. He decided to put his back to the port, in case it imploded, he wanted it to go through the thickest part of his suit. He wasn't surprised at the silence on the loop. He wanted to ask for a status, but it was his turn to give each of them that quiet moment to absorb the awesome beauty of nature. It would be over all too soon, as it had been for Dale.

"How's the window holding up, Ben?" Trap asked.

"So far so good."

"You want to repress?"

"No. It would use power we don't have, and I've got plenty of air in the suit."

"Copy."

Ben wondered what his wife was doing right now. Probably holding her breath and straining her neck watching the big screen in Mission Control. She wouldn't know he was in the airlock. Did his daughter even know they were in trouble? He supposed someone from the astronaut office would have gone to her school and brought her to her mother. At least he hoped so. He wished he could hug her and tell her not to be afraid.

Trap's voice calmly commanded, "Carolyn, get down to the mid-deck and prepare for emergency crew egress. I want you ready to go when we get to twenty thousand feet."

"I'll be ready," she said.

This statement made Ben's heart leap. The crew escape system installed after the *Challenger* disaster was only to be used if an orbiter was out of control. Trap wouldn't be ordering Carolyn to get ready unless the fuel cells were about to flood. And that meant no power. They would crash. Ben would have to repress the airlock now if he wanted to get out of there alive.

It was difficult to stand against the gravity, and Ben found himself feeling dizzy as he reached for the airlock equalization valve. He turned it to Open, but nothing happened. "Trap, there's no power to the equalization valve!" Like most valves, without power, it would remain in its last position, in this case, closed.

"The fuel cells are dying, Ben. I'm about to lose flight control."

As Ben slid back to the floor, he focused his attention on the empty maneuvering unit rack across from him in the airlock. *Now it's just another piece of space junk for Goddard to keep track of. And so is Dale. No, he's not junk. He's a satellite. And before long, he'll make one hell of a meteor as he cremates himself in the atmosphere of his home planet. Not a bad way to go.*

Then he heard Curtis say matter-of-factly, "Fuel cell stack temperature is over the redline."

"How long have we got?" Trap asked.

"Maybe five minutes," Curtis said.

"Shit." Sometime Ben would have to compliment his commander on his perfect choice of words.

"We're at twenty thousand feet," Curtis reported.

"Carolyn, open the side hatch and jump," Trap commanded.

"See you guys later," Carolyn said. "Good luck."

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

"Curtis, you're next," Trap demanded.

"No way. I'm staying," Curtis replied.

"I'm your commanding officer and you *will* comply." Ben could feel the anger in Trap's voice, shoving Curtis out the side hatch with the force of his words. Like all pilots, Curtis was reluctant to jump ship. He had brought a T-38 into L.A. on fire one time because he was afraid if he ejected that the plane would crash in a residential neighborhood. He'd been lucky to survive.

"OK, I'm going, but only 'cause I've got two kids that need a daddy. What about Ben?"

"I'll get the airlock open somehow, you just get out of here."

"Good luck, Ben," Curtis whispered.

"Thanks, Curtis."

Ben couldn't open the hatch unless the pressure on the two sides was first equal. He was sealed in a jar too big to run under hot water. But maybe he could break the seal! Any hole would do. He grabbed a tool from the belt he hadn't had time to stow outside, and began pounding on the viewport. The weight of the suit made him feel like a whale out of water. He kept pounding, but it was no use. He heard Trap trying to turn the handle from the other side.

"Trap, I can't repress the airlock. Go ahead and jump. There's no need for both of us to die." He didn't really fear his own death, but he didn't want to be responsible for another friend dying.

"I don't need no philosophizing," Trap said. "But I hope ya'll can swim in that oversized monkey suit. We just overshot Kennedy."

"Trap, I appreciate you trying to help me, but promise me you'll quit before we're too low for you to jump."

"Don't worry, buddy. We'll get you outta there."

Ben knew Trap wasn't going to jump without him. He had been the one to recommend Dale to the crew. His crew. He'd approved the EVA. As long as there was strength in him, he'd keep trying the hatch. With every ounce of energy he had left, Ben flung the latch tool at the viewport. The force of the implosion sent Ben smashing against the airlock side. Pain embraced him as his head whacked against the inside of the helmet and his chest felt like it exploded. He slid down the wall in a semi-conscious state. He was vaguely aware of Trap calling his name, of the airlock hatch opening.

In and out of consciousness, he felt Trap remove his helmet, roll him over to remove the backpack. Ben felt like a tranquilized polar bear. He forced his eyes open to Trap's weather-tanned face, beet-red with exertion. There was blood on his shirt. Ben's blood. From his broken lip and judging from the pain, his nose as well. But it was his chest that concerned him. He felt like a house had fallen on him. His breath came in short rasps.

"I'm pushing you out, Ben. The chase plane will spot you. I'll be along in a minute."

Ben wetted his salty-tasting lips and whispered, "Thanks."

"You're highly welcome," Trap panted. "I'm putting your helmet back on to make you float. Now off with you." With a grunt and a push Ben felt himself become weightless again, but

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

his chest still felt heavy. Soon the parachute billowed open, automatically activated. Ben judged the water to be only about five hundred feet below. If Trap didn't hurry, it would be too late for him to jump.

He looked for the *Voyager*, but it was already a dot on the horizon. Trap wasn't able to station-keep it now. And the sky was blue instead of black with the white shape above him a parachute, not Dale the Saint Bernard, now a real saint, orbiting the beautiful Earth. He pictured Anne, watching him on TV, wondering what he was thinking. What to say to Dale's wife. He struggled for air and whispered into his radio, "Worth it. Tell her it was worth it." He thought he heard Trap say 'amen' just before he hit the water and blacked out again.

HOUSTON—More pieces of the Space Shuttle *Voyager* were recovered from Florida beaches today after the tragic crash two days ago that took the life of the Mission Commander, Trap MacArthur. NASA officials say the Crew Escape System functioned properly, but the veteran astronaut jumped at too low an altitude.

Astronaut Dale Brumfield reportedly died in orbit during a still unexplained explosion that was the reason for the shuttle emergency landing. Speculation is that secret military hardware was involved.

One of three surviving astronauts, Mission Specialist Benjamin Cooke, remains in guarded condition in a Florida hospital with a severe concussion and a collapsed lung caused by a broken rib. He was found floating in a spacesuit used for extravehicular activity.

The two other survivors, Mission Specialist Carolyn Hunter, and Pilot Curtis Mayfield, were being flown back here today. NASA officials say they suffered only minor injuries.

In a memorial service to be held tomorrow at Johnson Space Center, the president is expected to put the vice-president in charge of a full-scale investigation into the crash. ■

●CENSORSHIP: Not letting me say whatever I want.

EDITING FOR GOOD TASTE: Not letting other people say things I don't like.

from *Kelvin Throop's Lexicon of Popular Parlance*

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

MATCHMAKER

Thomas A. Easton

Genetic engineering may give a completely new meaning to the phrase, "Who's in charge here?"

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

"Sit!" said Jimmy Brane. His dog's ears stiffened. The animal's eyes were bright and attentive, but his bulldog face was as blankly devoted as ever.

"You don't have the faintest idea of what I want, do you?" He walked behind Tige, tapped the gengineered animal's haunch, and said "Sit!" again. Nothing happened.

Finally, he squatted in front of the dog, sitting on his heels, his eyes on a level with the chrome model of an old eighteen-wheeler that hung from the dog's collar. His arms extended down between his knees. "Sit!"

Tige's mouth snapped shut. The ears tipped forward. He seemed—could it be? Jimmy wondered—to be saying, "So that's what you want!" And then, indeed, he lowered his rear to the ground.

"Is that all it takes?" asked Jimmy, still squatting, looking up at the dog. Tige was a young Mack just a little larger than an old-fashioned pickup truck. His hide was a dark brindle, with a single white circle around one eye. And he apparently was so smart that all one had to do was show him what one wanted, and he would understand, and obey.

"Shake hands?" he said, his voice uncontrollably tentative. He lifted one hand himself and watched, disbelieving, as Tige did the same. He leaped to his feet and seized the paw. "Shake hands!"

"Good boy!" he said then, and after a few minutes of watching Tige race around the field, he tried again, "Sit!" Tige obeyed immediately, and he also showed as well that he remembered his second lesson. Jimmy seized the proffered paw delightedly and laughed aloud.

Now! he thought, and "Now!" he said out loud. Maybe he had something that would catch black-haired Julie's eye and make her pay attention. Julie Templeton, who was a year ahead of him in the training program and resolutely ignored every attempt he made to chat, Julie who surely would never, never look at him, or consent to a date, or . . .

Teaching one's truck tricks just wasn't done. Jimmy had therefore deliberately chosen to begin Tige's training in the most remote of the Daisy Hill Truck Farm's many fields. If he had been nearer to the farm's barns and dorms, he might have been seen by his fellow trainees. He would also have been able to see the white fences that surrounded the nearer pastures, and he might have remembered the cattle the farm raised to provide the growing trucks with milk and meat.

Now, sitting obediently on the floor of his stall, stinking as only five tons of dripping wet dog can stink, Tige grinned doggily at his master. His stubby tail thumped cheerfully on the concrete.

"Litterhead!" said Jimmy. To one side of the stall rested a litterbug, a shovel-jawed genimal of porcine stock. Its task was to clean up manure and other rubbish. Unfortunately, litterbugs did not patrol the pastures.

"Litterhead!" Jimmy's face was directed upward, exposed to the rank gusts of dog breath. One hand was wrapped around a massive canine and tugging,

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

as if he could shake the Mack's head back and forth. "It wasn't enough to run, was it? You had to roll. And you had to do it where the cows . . ." Jimmy had had to walk the Mack back to the barn—he had been too filthy to ride—and then to hose him down before returning him to his stall. He had missed breakfast, and now he was late for class.

And it was his own mechin' fault. He shouldn't have been thinking of impressing Julie.

He peered down at himself. His light brown coveralls, the shoulders marked with patches bearing the farm's distinctive logo, a black-eared white beagle, were wet but not dirty. And the wet would dry; he needn't change. With a sigh, he opened a bin mounted on the wall, withdrew a biscuit the size of a football, and tossed it to Tige. Then he rummaged until he found a crumb a little larger than his fist, gnawed loose a chunk, grimaced, told himself that it was better than no breakfast at all, closed the stall's outer door, and left.

"Where have you been, Mr. Brane?" Jimmy froze, bent over the back-of-the-room seat into which he had been about to slip. His fellow trainee truckers looked at him and grinned. The instructor was glaring.

"Cleaning up Tige, Ms. Garland. I walked him in a cow pasture by mistake."

When the laughter subsided, Ms. Garland—Betsy to the staff members, he knew, but not to him, not to any trainee—leaned toward him, away from the chalkboard. She was a woman of distinctive shape, three times as large below as she was above, given to tent-like skirts and tight blouses, with the head of a blonde cherub atop it all. "I presume you did your reading last night. Tell us, Mr. Brane, why we bother to plug computers into the Macks's brains."

He straightened. He was not one to neglect his studies. "Yes, ma'am. It's so we can have total control of their movements on the road. But . . ."

"But what?"

"Isn't that kind of control unnecessary, Ms. Garland? It seems to be a hangover from when trucks were just machines."

"And now they're alive? And for centuries, dogs have been taught sheepherding, tracking, retrieving, and dozens of other useful tricks? So all we have to do is train them to obey voice commands, or gestures, or reins, and that will do?" She sighed as if she had heard it all before, as of course she had. Now she scanned the class. "Mr. Higgins. Why can't we rely on obedience?"

Alec Higgins, a rangy redhead whom Jimmy considered one of his few friends at the farm, said, "They might not obey. They could decide to chase something, or go after a bitch in heat."

"Not that." Their instructor was shaking her head. "The Bioform Regulatory Administration insisted that the gengineers remove that particular instinct. If they hadn't, even the computers might not be enough. But chasing, yes. Or attempts to socialize with other trucks on the road. You can imagine the traffic jams. And that's what made the BRA require rigid controls before letting Macks go into general use."

"But can't computers go wrong? What about sabotage?"

Ms. Garland nodded. "It's been done,

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

yes. Virus programs, and sabotaged chips. But that only led to new designs that are virtually impossible to subvert."

Tonya Metz, dark of both hair and skin, slim, and easily outraged, spoke before her upraised hand could be recognized. "But it's slavery! As soon as they're big enough to go on the road, we turn them into machines, nothing more than masses of muscle and nerves and control circuits. And—"

Ms. Garland nodded once more. "You're quite right. The Macks have much more intelligence than we let them use." She waited out the storm of approval from her students who daily lived with, trained, and loved their young Macks. "But that's the law, even though we may think it's unnecessary. The Macks have to have their freedom at the same time we do—in our off hours."

It would be two more years before Tige was big enough and strong enough to haul the great cargo trailers on the interstate greenways. Until then, Jimmy's days would continue to be filled with classes. He would learn computer operation, rules of the road, trucking history, even something of the gengineering that had created the trucks and other bioforms, and of the skeletal reinforcements that made it possible for them to carry their immense weight. He would learn how to care for his Mack, to watch his nutrition, to groom him and clean him, to notice, tend, and prevent muscle strains and other ailments.

He would even train Tige, under guidance, teaching him to accept loads such as the control and cargo pod that would be strapped to his back and the trailer he would drag behind for larger loads. Perhaps most important of all, he would teach Tige to submit when the computer was plugged into the socket in the back of his skull. The machine would then override virtually all influence of Tige's will, making him a prisoner within his own skull. It would take a great deal of time and patience and love before Tige would have the necessary faith that control would return, that submission was only temporary, that the abnegation of self was what his master demanded and deserved and that it was therefore right.

That evening, after dinner, when the Macks were all bedded down in their stalls and the trainees were supposed to be studying, Jimmy answered a knock on the door of his room to find Alec Higgins standing in the hall. "C'mon in," he said, gesturing toward the easychair. "I've got beer."

Alec's shoulder patches were identical to Jimmy's, though his coverall bore a broad red stripe from left shoulder to hip. He shook his head. "Nah. I just wanted to stretch my legs. Come with?"

"Sure." Together, they passed down the dorm's central hallway toward the staircase, ignoring the sounds of veedos, music, and conversation behind the doors they passed. At the head of the stairs, they leaned over a balcony to watch the dimly lit floor of the puppy barn below. Steel cages kept the pups away from the ground floor entries, and drainage grills surrounded the bases of the pillars that upheld the dormitory level.

The puppies were smaller than Tige was now but still huge, huge enough, Jimmy recalled, simultaneously to in-

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

timidate and to enthrall a young man, fresh out of high school, who had never seen them before. Now they lay in sprawling heaps, nestled in straw, windrowed against a wall, snorting, kicking, whining. Litterbugs quietly patrolled the floor.

"Making any progress with Julie?"

"Hah!" Jimmy raised his upper lip, fleering as might a Mack that scented something pungent. After a long moment of silence, he said, "Remember what you told me?"

"Mmm?"

"About how Julie and her friends rode their Macks to a local Scottish games."

"And the pups chased the cabers?"

"Yeah. Do you think she'd like a dog that does tricks?"

"You been teaching Tige to roll over?"

Jimmy gave a short laugh. "Not yet. Not that, anyway."

Alec grinned. "Maybe, but it ain't smart, you know. Keep 'em on the wire. Don't give 'em any choices. And BRA won't give you any trouble."

"I know, but . . . " Jimmy didn't think it was fair. Tige was obviously smart enough to train, quickly and well. He was probably smart enough to drive on the road without any computer hookup at all. Plugging him in must be like gluing a concert pianist's fingers to the keys of a player piano. No trouble, yes. But also no freedom.

"As for women," said Alec, with a wink. "The last thing *you* want to do is start rolling over for *them*."

Was that what Julie liked? Dog games? Tricks? Sitting up and shaking hands were kid stuff. But the Daisy Hill Truck Farm would not, he was sure, approve of building a catapult to throw tree trunks for the Macks to fetch. So maybe he should teach Tige to point every time he saw Julie. No. He shook his head. She probably would not consider that cute.

What could Jimmy do? How could he convince Julie to pay attention to him? She was older, yes, but not that much older. A year, that was all. That was nothing.

Julie herself had trained her Mack for riding. So had every other trainee, even him. Most straddled their truck's neck, hooking their feet under the collar. A few preferred to put a strap around the genimal's chest to bind a bench-like seat upon its back, which was much too broad to straddle.

How trainable were the Macks? No one knew. No one had ever tried to find out, for no one had ever needed to know. As soon as the Macks were grown, their computers made them do everything their masters wished.

It didn't take much longer for Jimmy to decide that perhaps, just maybe, if only he could train Tige to do something new, something no one had ever seen a Mack truck do before, something the computers were never programmed to *make* a Mack do, for it had nothing to do with trucking, then he could impress Julie and get her attention. And then . . . The grin he grinned in the privacy of his skull, he knew, was as fatuous as it could be, but the knowledge did not stop him.

The stock from which Macks had been gengineered had been dominated

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

by English bulldogs, but some showed strong signs of other stocks that had gone into the genetic mix. Julie's Mack, for instance, had a slenderer build and was marked with a few large, white spots on a black background. She resembled more than anything else a Boston bulldog grown up. Julie called her Blackie.

Jimmy stood near the bus barn, chewing his lip and watching the girl and her Mack as they left the stall. Blackie wore only her collar, Julie her farm coveralls and shoulder patches.

Blackie was half again as big as Tige, but that was only because she was a year older and that much closer to her full growth. Eventually Tige would match her, and they would make a pair of Macks well suited for the long-haul routes.

Would he—could he?—be as good a match for Blackie's driver? For Julie? He winced as his teeth came down too hard on a fold of skin. He would never have a chance to find out, would he? Tige was smart, yes. He learned quickly, and he seemed to grasp immediately whatever Jimmy wished. But he could not learn anything that the human could not teach. And Jimmy had been able to think of nothing that might have the remotest chance of making Julie notice him.

He wondered whether she might have any interest in the more abstract question of whether Macks truly needed computer controls. She knew they didn't, for she seemed about to go riding, and Blackie would do her bidding for love and eagerness to please. Not because she was forced willy-nilly to obey.

As Julie closed the door to the stall, Jimmy waved. She turned her head, saw who he was, and turned away. She swung onto the Mack's neck and tucked her feet beneath the collar.

"Litter," said Jimmy. Her deliberate ignoring of his greeting stung. He patted Tige's shoulder and said plaintively, "We haven't got a chance."

The Mack lowered his great head as if he understood. Jimmy climbed aboard, and they followed Blackie onto the turved greenway that passed the Farm, Tige's nails clicking occasionally on the patches of ancient pavement that poked through the grass. Jimmy wished that she would turn and notice him and pause to wait for him. But that didn't matter, any more than did her destination. In just a moment, he and Tige would catch up, while the farm's buildings were still in sight behind, and then . . .

What could he say? What could he do?

He could only try.

"Julie!" he called.

She turned, saw who was behind her, shook her head, made an exasperated face, and turned away again. Jimmy sensed the clear thought: He was just a kid, right? A year younger, a year less trained. Not worthy of her time.

He slapped Tige on the neck behind his ear. "Go on, boy. Get ahead of her." Then, as Tige drew abreast, he said, "Julie! I've done it!"

When she did not stop or seem to notice, Jimmy had Tige put on enough speed to draw ahead a hundred feet and stop. Then, "Watch!" he yelled, and "Sit," he said, and Tige lowered his hindquarters to the ground. "Beg," and the massive forepaws rose mantis-like

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

into the air. "Speak!" and a thunderous "Woof!" shook the air.

Jimmy untangled his feet from Tige's collar and slid down his back, checking the slide by grabbing handfuls of fur. Tige's skin twitched but otherwise the Mack ignored him, holding his pose almost as rigidly as a statue.

Blackie came nearer and stopped. Julie stared curiously, first at Tige, then at Jimmy. "How'd you get him to do that?"

"I showed him. And I bet Blackie would catch on just as fast." He gestured, inviting her to join him on the ground.

Jimmy watched her hesitate while the wish to know more rose to dominate her scorn for an underclass kid. He turned to the Mack and said, "Lie down." Tige obeyed, and when Jimmy turned back to Julie, he found her standing beside him, an arm's length away. His heart leaped within his chest. He swallowed painfully. She was interested!

"How did you show him?"

"I squatted and begged and lay down and rolled over. And he caught on real fast. They're pretty smart." He eyed her cautiously. "I bet Blackie could catch on, too."

She looked back at her Mack. The genimal was standing quietly, watching the proceedings with every appearance of alert attention. "There's not much point, is there? I mean, it's neat, but who wants a truck that can do tricks?"

Jimmy's spirits fell. He had been right. Such simple tricks were not enough. He waved a hand, and Tige promptly stood up. "But . . . ," he said. "It means that we can drive our trucks without the computers. We can train them to do what we say! We don't *need* to enslave them."

She shook her head. "BRA would never allow it. It's not reliable enough." She turned toward her Mack. "You're too idealistic."

Jimmy clearly heard the words she did not say out loud: "Grow up, kid. Forget the silly ideas."

Her tone changed suddenly. "Blackie! Hold still! Dammit!" Jimmy spun around. Julie was reaching for her Mack's collar, but the genimal was sidling away from her. "Look at this!" she cried. "If she had a computer, there wouldn't be any of this nonsense."

Jimmy had to agree that Blackie's behavior was unusual. "She's too young to be in . . . " He caught himself. When the gengineers had removed the male Mack's ability to respond to heat pheromones, they had also removed the female's ability to produce them, and to respond to male odors. They had, the textbook said, reasoned that while trucks should not respond to each other in that way, neither should the male trucks chase unmodified dogs, or the dogs chase female trucks. For the trucks, mating was necessarily a matter of artificial insemination.

"Look at her!" Julie had stopped chasing the Mack. Now she stood, legs spread, arms akimbo, watching as Blackie moved closer to Tige while Tige raised his head and sniffed. Then Jimmy's Mack stepped forward to butt Julie's with the side of his head.

Blackie stood still and cocked her head attentively. Now Tige barked once, softly, and sat. Blackie promptly followed suit. Tige shifted into the begging posture, and so did Blackie.

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

"I'll be damned!" Julie scowled and stamped one foot on the turf of the greenway. She turned toward Jimmy. "Did you teach him this, too?"

Jimmy shook his head. He was as surprised as she, but he was grinning with delight.

"Then help me separate them!"

"No!" he cried, putting out a hand to halt her movement toward the genimals. He hesitated, trying to think of a plausible excuse for denying her. "They must be trying to show us how smart they are."

"Bull litter!" She pushed his arm aside and reached for her truck's collar. Blackie responded by sidestepping, turning, facing her mistress, and barking once, gently, just as Tige had spoken to her. But she did not sit. Instead, using her nose, she butted Julie gently in the chest, pushing her inexorably toward Jimmy.

Tige simply lay down on the turf, his chin on his forepaws, watching. Jimmy reached out, and when his hand touched Julie's shoulder, Blackie backed off, lay down beside Tige, and joined the watch. Together, they blocked the road entirely. Fortunately, for the moment, there was no traffic.

Julie tried to jerk away, but Jimmy's hand tightened. "I think," he said. "I think your truck wants us together."

"It's none of her business!" she twisted and freed herself of his grasp.

"But that's why I taught Tige those tricks."

"What do you mean?"

"I wasn't really trying to prove we don't need the computers. We don't, but I really just wanted to impress you. To get your attention."

She was looking at him now. He was not quite a kid anymore. "And you expect me to think that my *truck agrees* with you? That I should let you court me? That I should . . . ?"

He said nothing. He simply stood, staring, his hands limp at his sides. The Macks watched them both.

"You are out of your ever-lovin' mind!"

Despite her words, his heart leaped in his chest. She was smiling as she spoke. Smiling at him. And the future bloomed as bright as it had ever done in his dreams.

But then he frowned. His mood crashed. *His* future was bright.

Tige's was darker than ever. His destiny had not changed. He was still the pianist who would have his fingers glued to the keyboard of a player piano, forced to follow willy-nilly someone else's score. But it was not just freedom Tige—and Blackie, too—would lose. Their controlling computers would deny them any chance to exercise the virtuosity they had just displayed.

"What's the matter?" Her hand was on his arm. Concern was in her voice.

He looked at the Macks. They understood so much. Perhaps they even understood this, though their doggy grins said as clearly as words that life held more important things to worry about.

He sighed. Worry was a human thing, wasn't it? Animals, even gengineered animals, tended far more to live in the moment.

Still, he would have to tell her. Perhaps, together, they could find an answer. ■

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

Probability Zero

SCHRÖDINGER'S LIFEBOAT

Jerry Oltion

The shrieking of alarms had quieted, but the crisis was not yet over. While computer-guided robots repaired the last of the damage left by the errant chunk of interplanetary debris, the four crewmembers of the astrophysical observation ship *Sagan* sat in the conference room and discussed their options.

"It's the classic lifeboat question," Aletha, the expedition leader, said. "Even accounting for reduced usage while asleep, we've only got air enough for two, but we've got four bodies using it. If any of us are going to make it back to base, two of us will have to stop breathing."

Tani, the quantum physicist, said, "We'll have to draw straws. Losers go out the airlock."

Gordon, the gravitational physicist, shook his head. "I don't think I could do that peacefully. If I drew a short straw, you'd have to kill me, and I warn you now, I'd struggle."

Aletha nodded. "We're scientists; we should be able to come up with a better system than that. Something humane, so the winners needn't kill the losers, and the losers needn't kill themselves, either."

"Who does the job, then?" asked Gordon.

"Chance," said Kharil, the astrophysicist.

His three crewmates looked at him in puzzlement. "Chance," he repeated. "A random event, triggering poison gas into a sleep chamber. We all take enough sleeping pills to put us under, and we leave the computer set to target each sleep chamber in turn, say once every millisecond or so, while also sampling a radiation counter each time. With a normal background count it would take thousands of cycles before it detected an emitted particle. When it does, it triggers the gas in whatever chamber it's pointing to at the time. After it's gassed two of us, it stops sampling and the other two survive the trip."

There was a long silence while the other three crewmembers considered his plan. Finally Tani spoke. "We can do better than that. If we're careful, we can set it up so there's a fifty-fifty chance

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

we all survive. Of course the drawback is there's a fifty-fifty chance we all die, but my way it's all one way or the other. Nobody has to die so the others can live."

"How can we do that?" Gordon asked. "We don't have the air to keep us all alive."

"No," Tani said, "but we do have the air to keep us all *half* alive. Now, here's the plan. . . . "

The rescue crew boarding the research craft were prepared to find signs of a struggle. From the report they received before the telemetry had mysteriously stopped, they knew that the ship was short of air, and from human experience gained over thousands of sea and space accidents they knew what would most likely occur in such a situation. Therefore they were surprised to find all four crewmembers still alive, sleeping peacefully in their sealed chambers.

The poison gas canister hooked into the air system, but not opened, puzzled them still further. The sleeping drugs in the crewmembers' bloodstreams —enough to ensure that they slept until well beyond rescue but not enough to kill any of them—were also a puzzle. It wasn't until they cleaned the drug from Tani's system, and woke her, that she was able to enlighten them.

"It's Schrödinger's paradox," she explained, grinning wide and pinching herself to be sure she was really alive. "According to quantum theory, a single quantum event, like a radioactive atom's decay, is unpredictable. It's actually a probability wave, existing in both its possible states simultaneously until someone observes it and forces it to be one or the other. If you set up a situation in which a macroscopic event is tied to the quantum event, then the macroscopic event is indeterminate as well. Schrödinger used a cat in his thought experiment; we used ourselves."

"What does that have to do with the poison gas and the sleeping pills?" one of the rescuers asked.

"Simple. We rigged the poison gas to kill us all if the computer detected a decay product in a radioactive sample. We chose the sampling time so it would have a fifty-fifty chance of finding one. The sleeping pills were to keep *us* from knowing which it had done and thus determining the state of the experiment too early. And that's why we shut off the telemetry: so *you* wouldn't know which way it went either."

"I still don't see how that kept you alive," the rescuer said.

"It didn't," Tani explained. "It kept us half alive. As long as nobody made an observation, we were in an indeterminate state. Half dead, half alive. That meant we were using only half the air we normally needed. When you boarded the ship you forced the universe to make a choice between states, and here we are."

Another member of the rescue squad entered the room, carrying a yellow cat in his arms. The cat gave a plaintive yowl when it saw Tani.

"Ginger!" she exclaimed. "We forgot all about you! Oh, poor thing; you must be half starved." ■

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

The Alternate View

DIETING

G. Harry Stine

I'll bet you thought that only people engaged in dieting. Let's take an alternate view, one in which we broaden our viewpoint in hopes of finding some interesting analogies having to do with the behavior of both governments and businesses. Or large organisms and organizations in general.

Given: All organisms are programmed to grow, but those that exist in an environment where demand exceeds supply must and do go on diets in order to survive.

Let us define our terms.

Organism as used herein includes not only single-celled living organisms, but also multi-celled living creatures such as human beings. The word also includes collections of organisms which for purposes of discussion herein shall generally mean human social institutions.

The word *institution* means an organism that is a group of human beings. It's organized for some purpose or purposes. Members follow rules they agree upon. It has a structure that, in its simplest form, amounts to a leader and a few followers. It has internal protocols so that its members know who's in charge and the relative ranking of individuals within the group's organizational structure. These protocols include rewards for activities that benefit the group as well as punishments for breaking the rules. In line with this, the group may develop a means of keeping score so that those who are rewarded may be recognized commensurate with their activities, and those who must be punished may be suitably dealt with. Procedures exist for admitting new people to the institution as well as for handling members who must leave, voluntarily or otherwise. The institution also has rules that guide its relations with other institutions. It's important to realize that an institution is a group of individuals and not a collection of ideas, rules, practices, or customs. An institution is also an organism.

Dieting has different meanings to different people, depending on which organism they refer to. Here the word will be used in a very general sense: getting rid of unneeded resources or elements of an organism. Different buzz-words are used with different organisms —downsizing, cutting out the fat, belt-tightening, reduction-in-force, budgetary cutbacks, economizing.

Gee, these definitions are pretty broad, aren't they? Yes. And aren't they too simplistic? Yes. But please let's start with broad, simple concepts; they will get as big and complex as you want to make them quicker than you believe possible. If you want to keep it simple, others will certainly do their best to make it complicated. So don't ever worry about being simplistic at the beginning.

It appears that all organisms, includ-

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

ing institutions, are preprogrammed to do two things: (1) survive, and (2) grow. It's true that organisms can survive without growing, but without growth they're stagnant or in decline. Organisms do not evolve unless they grow. Perhaps growth is also tied to evolution. It would seem to be the case in an environment where organisms compete for available resources. That's another subject for discussion.

In his *Note Books: Lord, What Is Man?*, Samuel Butler wrote, *"All progress is based upon an innate universal desire on the part of every organism to live beyond its income."*

So what are we getting at here?

America and Americans appear to be compulsive, progressive dieters. Both as a nation and as individuals, we've figured out a way to live beyond our income by creating wealth and thus income. We've learned that economics isn't a steady-state subject, just as the Universe isn't a clockwork steady-state place.

But creating wealth and income—and thus improving our general condition—makes us feel guilty as hell. This seems to be the case whether it involves comparing our life-style against that in another part of the world or looking at ourselves in the mirror every morning.

Individually, we're proud of acts that make us more fit and trim. We're ashamed of the gluttony that forces us to try to reduce. The refrigerator and shelves are full of food. So we scarf down the calories with wild abandon because they're there. Why? Whether we hear it or not, or even admit it's there, a quiet voice in the back of our mind whispers subvocally, "Eat while you can! This is probably too good to last. It's been worse in the past and it could be worse again tomorrow."

Relax, dear friends. It *is* instinctual. It's built into our ROMs. It's also part of human physiology which is attuned to gorging ourselves while food is there to be eaten. Thousands of generations of hunters, our ancestors, refined this philosophy. Those who followed it survived to breed, culminating in us.

So we fight this former survival instinct. When the belt gets out to the last notch or the bathroom scale goes bananas, we announce a diet. Or we patronize a weight-loss clinic. When the desired amount of weight is shucked, very few people can keep that weight off. So back we go to the diet clinic. Of all the enterprises in America today, the diet clinic is a better business than having the exclusive mortuary franchise in a retirement town; it's a sure bet for a continual stream of new and repeat customers. The mortuary doesn't get repeat customers. . . .

We create our own institutions. And our institutions suffer from the same cycle of survive/grow and downsize/cutback. Both our government (which doesn't have to show a profit) and business activities (which do) go through regular ups and downs.

Government wants greater revenues and businesses want greater earnings and profits. So they grow. They upsize.

The government figures out new services that its citizens are willing to ante up taxes for, so the government increases revenues to support the service; the innovative entrepreneurial firm goes to market with a new product that brings earnings and profits.

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

Soon, the growth program kicks in almost like a Trojan horse program in a computer. Facilities are built, infrastructure is established, and people are hired to do the work involved. The government doesn't really have to produce anything, but its citizens must perceive that their taxes are spent wisely and according to their wishes, or not in accordance with their objections. In business, the company gets far ahead of the competition and the increased costs of growth to meet anticipated demands can be passed along to the customers until price resistance is encountered in the market place and reflected in sales data.

Institutions grow along the same S-shaped Gompertz curve as a yeast culture in a petri dish. Growth becomes a goal for both people and their institutions almost as an imperative. Why? I'm not sure I know, but I can at least ask that question; the yeast culture in the petri dish can't. But the behavior is the same.

Those in a growing institution create commissioners or vice-presidents like crazy. These people need more people to manage and supervise. Because the growth curve takes off and climbs very quickly at the start, the institutional leaders believe they're faced with a time problem. So they engage in a lot of short-term tactical planning and very little long-term strategic thinking.

But human beings are motivated; yeast isn't. What is the institutional motivation for overgrowth? It comes from a sense of being time-limited because of linear thinking and imperfect forecasting. To handle anticipated future growth, more and more people are hired; organizational infrastructure is created; the institutional structure becomes increasingly complex. Empire builders rage unchecked. To raise revenues, governments raise taxes. To increase sales, businesses increase capacity. Neither one ever wants to get caught short when the demands of the electorate or their elected representatives exceed their capabilities or when production can't keep up with orders. So people who run institutions upsize them because of lag time within the system, but they don't really know what the delay time is. If they did, they might be able to control the growth a little bit.

In both government and business, the systems used for evaluating executive and management positions look at only such things as number of people supervised or the expense/earnings dollars.

Finally, the institution reaches a discontinuity as the S-curve begins to inflect to the horizontal. It takes more and more time, effort, and money to get something done. These are the first signs of overgrowth.

Government institutions go looking for more revenues and finally discover they can't be obtained by tax increases because of taxpayer objections or because they are simply bleeding the country white. In business, profits stop increasing but the competition keeps right on growing because it's leaner, meaner, trimmer, and harder.

So what does government and business do? Exactly what individuals do: Go on a diet. Visit the diet clinic.

Enter the bean counters, the controllers, and the analysts who do the kidney punching and play Attila the Hun in

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

bringing order out of the chaos of unchecked growth.

Because of its own internal personnel rules, government can't lay off its civil servants easily; a reduction in force usually means a hiring freeze which reduces the personnel count by attrition. Business firms have developed all sorts of ways to pare the work force—offering early retirement, requiring a move to the office in Nome, moving the desk into the hallway or the bull pen, assignment to a position outside the individual's area of personal expertise or experience, cutting off all authority to make decisions but none of the responsibility for whatever decisions are made, and (horrors!) even the pink slip and severance pay.

How can this cyclic behavior of growth-diet-growth be stopped?

It takes brains and will power, as any dieter will tell you.

First principle is a commitment to meeting customer needs.

For an individual, the customer is the person's body. For government, it's the real needs (not the desires) of the citizen taxpayers. For a business, it's what the customer truly wants to buy and is willing to pay for. Figuring this out requires something called "marketing." Individuals have a tough time dieting but rarely keep the weight off. Businesses manage to do it in order to survive (but some don't), then usually go through the cycle again and again until they go Chapter 11. Governments rarely succeed at all (and so empires decline and fall).

The second principle of dieting is reward for meeting clearly defined goals of performance, not growth.

The third principle says to use disciplined planning. This includes using forecasting techniques based on customer demand rather than institutional capacity—i.e., what your body needs versus what's in the cookie jar, what the government really should be doing versus what it wants to do, and what a business is really doing versus what it thinks it's doing.

However, if growth happens to be part of the performance goal, especially for those individuals or institutions that haven't yet matured, the milestones should be firmly established ahead of time. These milestones are go-no-go points. If the dieters don't make the requirements of the milepost, they don't go on until they do.

As any person knows, it takes discipline to go on a diet, to stay on a diet, and to stay lean and mean after the goal has been achieved.

But why bother? If it's part of instinct, why stop being a glutton? Why not allow the cyclic nature of growth/dieting to continue? Well, the consequences of continuing boom/bust may, in the long run, be far more expensive than discipline.

Hey, when we started this, I didn't say anything about having the easy, simple answers, did I? ■

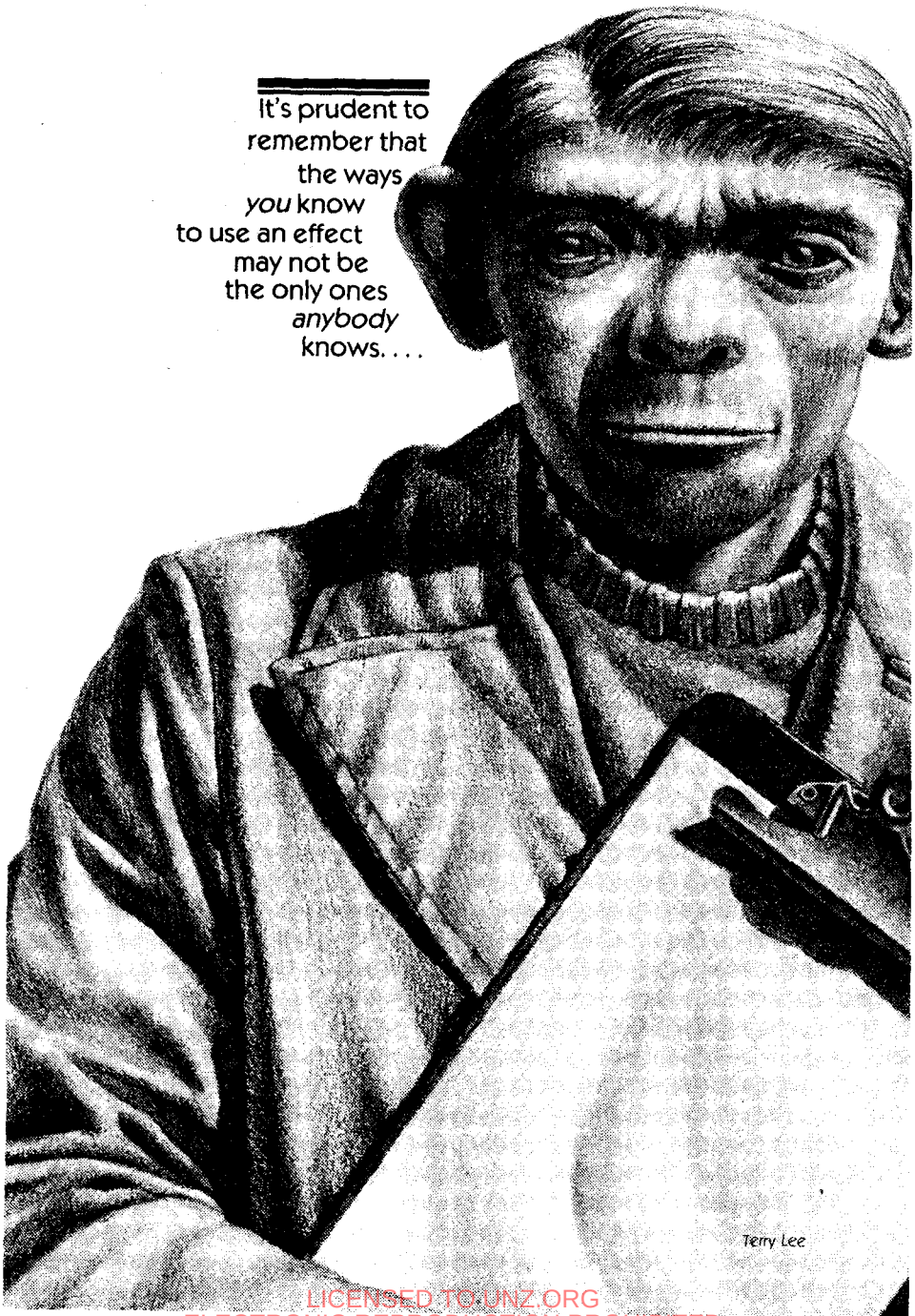
●Civilization is the most fragile ecology of all.
Frank Olynyk

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

ADAM AND EVIL

Joseph H. Delaney

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED



LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

Morning Hibiscus was Foroschiki Power Company's most powerful, most modern space tug, a state-of-the-art specimen of trans-lunar space vehicles, but still no royal yacht.

No such vessel existed. The need for one was not very great, since never before had a royal personage of any nation ventured off the Earth. Prince Yoshio was the first, and while he was not in the direct succession, his older brother having sired five sons already, the venture was not undertaken lightly. He was here because it was necessary.

Morning Hibiscus reached the designated point in space and slipped into circumlunar orbit, descending in ever decreasing spirals until larger features of human works on her surface could be seen with the naked eye—the normal naked eye, that is.

Prince Yoshio's were not normal, though it was the hope they soon would be, which had inspired this momentous journey. He now hovered, hands on the safety bar, next to Captain Kuboyashi and "gazed" out the unmasked portal.

"I 'see' the brightness, Captain. Are those the power cells?"

"Yes, Highness. There are almost 15,000 hectares of them already and more are being installed every day. It is already the largest source of energy available to man." Kuboyashi's voice was proud, his nation's presence in space was second only to America's, and even that gap was closing.

But Prince Yoshio was troubled and did not allow this mood to infect him. "Where is Copernicus Station, Captain? I do not 'see' the domes."

"They are difficult to find—Highness." Kuboyashi checked himself. He had almost added, "even for normal people." He did not believe the prince would have been offended but had no wish to test the assumption. The prince was blind. He "saw" through an electronic device that converted photons to electrical pulses which a microprocessor then displayed as tactile sensations on an area of his upper back. Somehow, the brain translated this into a crude monochromal image good enough so the wearer could get around and manipulate large objects in good light. "The dome complex," Kuboyashi continued, "is buried under a layer of rock wool which acts as a radiation and meteor shield." He did not add that it lay in the exact center of the solar array and that he could see it quite plainly.

Morning Hibiscus passed out of sight of the complex, drifted over Copernicus Crater, which lay immediately to the west of it orbitwise, and finally around to the darkside, where there was at the moment nothing to see. Though Kuboyashi normally would have been attending duties concerned with their impending planetfall, these were now undertaken by others, he concentrated instead on entertaining the prince.

This was not an onerous task. The young man was highly personable, with no imperial airs, perhaps even a trifle too egalitarian, in Kuboyashi's humble opinion. But then the captain was just barely old enough to remember the prince's great-grandfather, Emperor Hirohito, who had been even more reclusive than his grandson, the present sovereign. "We will inject on the next pass, Highness. There is a couch for

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

you, though there is yet much time before you need to get into it. Our descent begins on inboard power, then the laser complex takes over and lowers us very gently to the pad." *I hope,* Kuboyashi added silently.

Accidents did occasionally occur, and every so often there was a tiny error of alignment. Usually, a ship in such straits could recover, and either correct or use its own engines to get back into a stable orbit. But there had been half a dozen spectacular accidents in which ships exploded, or their controls or power plants were damaged by the blasts. These had plowed the long furrows on the slopes of Copernicus's outthrow, man-made meteorites, immense coffins for lifeless crews.

Kuboyashi did not allow himself to dwell on that possibility for *Morning Hibiscus*. He chose instead to begin the travelogue he customarily gave to visiting company officials about this time in orbit. "Foroshiki chose this locality because there is a large mascon nearby, fairly close to the surface. Our operation generates gigawatts of power and the process of transmission converts a substantial percentage into heat.

"The facility does not have sunlight all the time, so the mascon is our storage unit as well as a heat sink. It helps us adjust power production to meet customer demands.

"The dome, actually domes, since there are four of them, range in size from our own fourteen kilometer construction to the comparatively tiny two and a-half kilometer one that Deering Universal Transmatter uses. They all employ the original Fuller design, of course, but are built of lunar materials, each within its own crater. We have connected them by tunnels at the various levels.

"Part of the body, or bodies, which created Copernicus Crater were of the stony variety, fortunate since they contained comparatively enormous quantities of hydrates. There was a vast underground flow of this, part of which extends under the complex. It rose above the mascon because it was lighter. We mine hydrate to create water, using the abundant oxygen in the surface rock and our spare generating capacity, consequently this facility is richer in water than any other Lunar settlement, rich enough so that Foroshiki can operate a large fish farm."

"I look forward to a tour," the prince responded, "once my operation is over."

Kuboyashi did not immediately reply. He had detected a note of skepticism in the prince's voice, and did not want to risk amplifying it. Prince Yoshio's blindness was the result of a tragic accident. Like his great-grandfather, Prince Yoshio believed a man had a duty to examine his environment and try to understand it. Unfortunately, times had changed. While the old man had confined his explorations to the safer subject of marine biology, to which he had made important contributions, Prince Yoshio's interest was in microcircuitry.

He, too, had been on a verge, hot on the trail of a fascinating new effect whose ramifications were still not completely understood though others had since carried on. Some of the exotic doping agents he had been using were compounds of gallium and he had been

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

blinded by the escaping vapors of one of these.

Where once he would have spent the rest of his life groping about with a white cane, or following a guide dog, now he had the tactile system, better than anything that came before but still a poor substitute for his own eyes.

And that was why he was visiting the Deering facility. He had hopes that Adam Schoonover, a former classmate at the University of Texas, could give him back his own eyes.

"I'm sure Your Highness will enjoy it," Kuboyashi replied, with new optimism.

The remark derailed Prince Yoshio's glum train of thought. He got a new grip on himself, resolving to be as optimistic as possible. There was reason for joy: after all, Adam and Marta were his good friends, whom he had not seen in far too long, and even if the operation failed the trip would still be worthwhile. He was about to speak when a crewman called out to Kuboyashi that the terminator was four minutes away.

"I will help you into your couch, Highness," the captain said. "It is normally occupied by my second officer but you will be able to watch the big screen from where it is located." Instantly, he regretted his choice of words, he did not know what the prince could "see" or whether the device he wore worked on such things.

But it passed without comment. The prince signalled his readiness, then floated behind the captain to a couch on the extreme right of the command console. Other crewmen scurried out of the way and the pilot began running his checklist for final countdown.

Prince Yoshio strapped in, allowing Kuboyashi to examine all his restraints and make minor adjustments to them. Then, while the captain assumed his own station next to the pilot, Yoshio pointed his sensor at the main screen.

From the standpoint of brightness it was better received than any natural image though, of course, details were just as fuzzy. The system had not nearly the resolution that the human eye, or even its robot equivalent, could muster.

Still, Yoshio could make out the magnified image of the laser array at the edge of the immense expanse of amorphous silicon collector panels, including the big blockhouse from which these were controlled. He felt a surge of pride in this. While these did not handle anywhere near the tonnage the US facility at Matagorda did, its lasers were actually far more powerful. Yoshio knew that future plans contemplated an even bigger system—one capable of hurling vessels completely clear of meaningful solar influence, one which would launch interstellar probes.

A klaxon sounded, even as the display changed from the surface view to a fractal representation based on data gathered on the ground and augmented by telemetry from *Morning Hibiscus*'s own instruments. Yoshio's sensor was not capable of resolving the finer details of the display but he knew that logarithmic representations, from which their relative positions could be inferred, were now showing on the screen.

Then he heard Kuboyashi's voice — crisp, clear orders to the pilot to burn on his mark. A momentary silence followed, then the moment came and a small weight descended on Prince

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

Yoshio's chest. This passed momentarily as the captain shouted again, but returned twice more after that.

Again, there was a respite, then a different kind of disorienting movement, coming from attitude thrusters, fired much less energetically than the retros but operating on a different axis. Prince Yoshio felt momentary nausea. This, he attributed to his blindness. He knew it was not usual.

The klaxon sounded again. There followed a five second countdown, and then the main engines fired. The impact was a double one, the first absorbed by the second, which was continuous, though of steadily decreasing force.

Prince Yoshio knew what was happening. Using the *Morning Hibiscus*'s own jet wash to calibrate and align, the lasers fired, then automatically the inboard system shut down and pumps began hurling massive quantities of water from the nozzles and into the ship's "bell." *Morning Hibiscus* became in effect, a huge steam rocket. The reactions were so energetic that it was as if a giant hand had snatched up the vessel in full flight and stopped it dead still, though it was really falling toward the lunar surface at a substantial percentage of the local gravitational acceleration.

The ferocious heat of the lasers tore the water molecules apart, and in the nanoseconds before dissipating, their constituent atoms transferred the energy of this reaction into the bell. Mathematically, the reaction was, of course, far more complicated than that. Many atoms took part in it more than once, recombining explosively only to be ripped apart again, and loose more energy into the system.

Morning Hibiscus rode this tail of plasma to the ground, at the last moment firing her inboard system at the precise instant the lasers cut out, then dropped the final meter or so onto her shock-absorbing landing jacks.

Yoshio felt even more peculiar once down, curiously heavy compared to what he had been, and with his muscles awkwardly assertive.

Kuboyashi was already out of his couch and helping the prince out of his. "Your Highness will acclimatize," he said. "It takes only minutes. Going back to Earth normal will be the hard part."

"So I understand," Prince Yoshio replied. "What happens next?"

"We are on a giant turntable. This is rotating slowly and in a short while will take us to a tramway, which in turn will take us to a berth. Ordinarily, we would simply drop pods of cargo, reload, and depart, but *Morning Hibiscus* will remain here for the duration of Your Highness' stay. We will be traveling to the Foroshiki Dome by tubetrain, from which Your Highness will be escorted to the Deering Complex at his pleasure."

Prince Yoshio's eyebrows rose imperceptibly at this formal reference to his person. He had always been uncomfortable with such things, and up until now Kuboyashi had not troubled himself with them. Prince Yoshio attributed this to the fact that now there would be others around, and to the captain's natural confidence while on board his own ship. Being around Adam, he reassured himself, would be a nice change.

When the berth was reached *Morning Hibiscus* was mated to a device similar

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

to the familiar aircraft boarding ramps. Prince Yoshio strode confidently along beside the captain, trying his best to match the spaceman's easy stride and to accomodate himself to the lunar gravity. He did not manage this very well and was still having difficulty when they reached the second lock. They then descended beneath the surface on an escalator, which dropped them onto a beltway, which carried them to a tube-train terminal. Kuboyashi knew his way around.

To Yoshio's everlasting disgust, the train had an entire car reserved for him. This was contrary to his wishes so he entered it reluctantly, having previously been delighted to find that most everybody in the terminal had ignored him. It would be different in the Foroshiki Dome, but here in the common area of the port, peopled mostly with Caucasians, there had been no advance publicity of his visit and he was not as familiar to them as he was to his own countrymen.

He sighed and stepped aboard to take his designated seat. The doors closed, and from some hidden orifice a synthesized female voice announced successively in four languages that departure was imminent. Yoshio sat back to let the natural darkness of the tunnel function as his eyelids, and envelope him in darkness. How strange, he thought, to miss the most natural function of his eyelids now? He never had before.

The sign on the door was not ostentatious, it said simply, "Dr. Adam Schoonover—Dr. Marta Schoonover," all on one line, which signified the extreme closeness between them, the perfection of their relationship that anyone who met them noticed at once.

That had not always been so apparent, the two had at first seemed star-crossed. Adam was a hybrid—the product of a daringly brilliant experiment by his father, Delmar Schoonover, and the only member of a new hominid species derived principally from basic *Pan* stock, but spiked with Schoonover's own germ plasm. The result was Adam, fully sapient, fully human—but a late bloomer. Tragically, in his infancy this had not been obvious. The sensational press got hold of the story, was rebuffed, and sought vengeance. Schoonover endured a federal prosecution for enslaving Adam, but upon evidence that he was Adam's parent he was acquitted.

Part of the problem had been communication, Adam couldn't speak well, even though the extensive surgery he had had as a baby had promised he might someday. And as Adam grew it seemed to be true—until it was discovered, when Adam tapped the panic thoughts of a murderer, that what he really did was eavesdrop on other people's thoughts, in effect "hearing" them, and "speaking" by projecting his own thoughts.

Adam was a telepath, the only one he thought, a fact that further distressed his family, who shared the secret only with few intimate and trusted friends. But the faculty had a good side, too, and led him to Marta.

Marta was ten when the adolescent Adam found her, deep in the Colombian forest. She was a deaf mute, whom nature had compensated in the same manner as it had Adam, and the daughter of an unwilling participant in the dope

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

trade. Her father had been killed during a raid in which Adam had participated. Adam was never the same after he heard her silent, telepathic screams, but he knew he had to find her again. In that instant he became her mate.

When he finally found Marta she was the prisoner of the evil dope lord, Don Peyote, who had learned of her strange attraction for Adam, and who suspected Adam was somehow behind all his troubles. During her rescue their friendship with Mike Deering was forged.

Behind the austere sign, beyond the unadorned door, the furnishings were anything but simple. Communication devices filled the bulk of the chamber, whose upper wall was ringed halfway around by video screens. Through a private corridor was the laboratory they shared with Mike and behind that, in a separate dome a safe distance from the rest of the complex, was the latest scaled-up version of Mike's Gee-whizmo-Gizmo.

The Gizmo was originally conceived as a matter transmitter, but while it did that very badly it turned out to have other redeeming features. The Schoonovers had been using its scanning and recording capability to pioneer the editing out of physical defects in living creatures.

Adam, Marta and Mike Deering, had been working on Luna almost since the settlement became life sustaining. Here they lived secluded and comparatively sedate lives, untroubled by the occasional upheavals of bigotry that had erupted periodically among the less tolerant elements of the race.

There were no such people at Copernicus. Here Adam, an M.D. following in his father's footsteps, and a practicing genetic engineer, peacefully pursued this fascinating line of research, while Marta literally created new plants daily.

And they were about to take yet another quantum leap.

While he waited Adam had been relaxing, leaning back in his chair, his feet, shod in special shoes which accommodated his prehensile great toe, resting on one corner of his desk.

Presently, a bland beep erupted from his wristphone. Adam held it up to his ear and listened. What he heard was only so much noise, but his mind perceived things differently. The sound's sole function was to focus the thoughts of the caller, one of the lockkeepers, who said Prince Yoshio's train was at their station and his arrival was imminent.

Adam muttered his thanks and gave a mental shout to link with Marta, who was back in the lab, winding up an experiment. "He's here, Marta. Come."

Adam's feet dropped to the floor as the office door opened. He rose and walked toward it, hand outstretched to grasp Yoshio's. He knew this moment would require great care, lest the pity he felt bubble out along with his projected thoughts.

"It's good to see you again, Yoshio," he said, leading his guest to a nearby chair. "Marta's on her way."

"It is the same for me," Yoshio replied. He felt good in this moment. Adam and Marta were people who genuinely understood him, a rare thing among westerners, rarer even than their uncanny fluency in Japanese. Yoshio

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

had never really understood how they had managed that.

Marta bolted in the door behind them, but unlike Adam she did not just shake Yoshio's hand, she gave him a most proletarian hug before settling down to share Adam's chair with him.

Adam squirmed beneath her weight, making the adjustment more comfortable, then endured a nibble on his ear. Marta was a very demonstrative person, a typical Latina, and very irreverent of formality.

"So," she said casually, pointing to Yoshio's sensor, "you can throw that thing away now, Adam will fix you up. He is becoming a very good editor."

"A what?" Yoshio had always had a little more trouble following Marta than he did Adam, though he didn't know why, since her Japanese was flawless.

"That is essentially all he does, you know—it is all I do. We watch as the machinery scans, and if we see a mistake, well, we just erase it and do it over right."

"What is she talking about, Adam?"

"She oversimplifies, of course, but is essentially correct. You see, to transport we must first scan and record. I'm sure you can appreciate that is complicated enough in itself, and requires computing power whole orders of magnitude above what was available just a decade ago."

"I know a little something about that part of it," Yoshio replied. "What does Deering use as a recording medium?"

"Garnet, doped with arcane alchemical concoctions," Adam replied. "Also, periodically, he sacrifices a virgin to the slime god. Beyond that, things get a little too deep for me. He talks about bubbles and stuff. . . ."

"It's getting a little too deep for me as well," Yoshio responded with a chuckle. Then the serious side of him returned. "Magnetic bubbles, yes—that would be essential. Uh, I've never met him, you know, but I am familiar with the technology. I-I made a c-contribution."

Adam felt panic. He had triggered this. There came a reassuring thought from Marta, set in a subtle way using a technique she had never succeeded in teaching him; Marta blocked from Yoshio.

He is a strong one, Adam. He can endure it for a time.

Bolstered by her confidence, Adam shed a reckless thought before he could stop himself. "You will make many more such contributions, Yoshio. I'm certain of that—certain I can fix you up. We've had some absolutely astonishing successes with animals, and now that we finally have facilities big enough to accommodate people, human medicine can expect the same kind of advances."

Yoshio's sensor was pointed at Adam, though Yoshio didn't answer.

Adam somehow found this disconcerting—the thought that his friend was staring at him with lifeless eyes and feeling his image on his back. It gave Adam the willies.

Marta must have felt a twinge, too, because she then stepped in and saved him. "You see, Yoshio, the original problem with the Gizmo—that's its official designation, and the big one's the Great Gizmo—was its short range and low capacity, and the fact that the process reversed transported objects like a

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

mirror does images. Mike has solved the reversal by ganging the system. The other problems he simply overcomes with brute force. Up here we have the power we need, so distance has been extended, theoretically up to a full kilometer and the maximum load to 140 kilograms. That's at full power, of course, though current experiments haven't yet demanded that."

Yoshio blinked involuntarily behind his sensor, never dreaming that Marta would be able to pick it up.

She did, of course, as did Adam, but only as the mental suggestion of a gesture, its only function to signify Yoshio's astonishment.

And he was truly astonished. Yoshio was a good enough mathematician to appreciate what kind of power consumption her words implied.

"I started out with tiny things," Adam continued, taking over from his wife. "We found that we could use the Gizmo and our primitive recording techniques to snip DNA out of cell nuclei far more accurately than we could with enzymes. All we had to do was record, and then by making systematic changes in the record, trial and error would eventually get us what we wanted."

"Trial and error?" Yoshio's astonishment grew.

"Sure, you can't beat it when it gets up to speed, and it could with the Gizmo. Before, we used such things as viruses, transposons, and plasmids to move the stuff around, but in most instances the separation and reinsertion of nuclear material was an all-day job—if you were lucky. Back then it paid to try to forecast possible effects, but using the Gizmo we can now do much more precise operations in mere seconds. That in itself is a quantum jump.

"Of course," he went on to explain, "that's with single cells. When it comes to organs we have to work harder, but there we have the advantage of long-standing familiarity. We know, for instance, how a heart should behave, and what tolerances it has—all this was worked out in the last century. We've even started to fabricate standard artificial organs.

"How we repair an organ depends on what's wrong with it. Some things are relatively simple, like replication of cells for healing lacerations, where once we build one right, we can mass produce it so to speak. Nerves are a little harder but the principle's the same. When we get enough of the right kinds of cells we build the organ to size and scan it, or use a computer model of it, then substitute its pattern for the defective one.

"Again, I'm oversimplifying, but organ reproduction really is fairly simple once you've got the basic plans. Harder to fix are genetic defects, because we have to go into the mitachondrial DNA, and hardest of all are those which require us to alter the germ plasm itself; we really have to be careful there.

"And, of course, the ultimate challenge is replacement of organs an individual never had to start with or which have been surgically removed, because we have to worry about immune reactions. Those sometimes take a while to get right."

"What about eyes?"

"I think yours will be a relatively straightforward procedure, Yoshio. I'm very optimistic, it should be plain old cook-book surgery. We'll spend most

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

of our time mapping your patterns and trying to avoid doing anything that will get your antigens riled. You'll be a pathfinder, of course, the very first human being to undergo ocular replacement.

"There is risk, as always, but not a great risk. Mike built dozens of fail-safe mechanisms into the system, including three-to-one redundancy. For every live object passing through the system three separate records are made."

"You mean, three of me will come out?"

"No," Adam replied. "Only one materialization occurs. The program won't permit a duplication unless it scans the copy that emerges and finds it was flawed, and even then an override command would be required to do it. Of course, once the input and output are determined to be equal the system deletes the superfluous record, because these use so much memory."

"I can appreciate that," Yoshio answered.

"Then you understand why we're so optimistic?" Marta added. "It's really exciting. Adam forsees the day when no genetic defect will cause illness, or be transmitted to succeeding generations. His father thought that it would be miraculous if he could just eliminate Huntington's disease, or sickle cell anemia, but this has possibilities beyond Delmar's wildest dreams. In a generation such terrible things as diabetes mellitus will be history. The same for arthritis and lupus and—and well, almost all of the common causes of systemic human illness; and that prediction may be too conservative, this could well be the road to immortality."

Yoshio had no chance then to ask her to elaborate on this most intriguing remark. Deering's call interrupted, and they went to meet with him for lunch.

"You'll understand it better later," Mike squealed enthusiastically.

Yoshio hoped so. At the moment he was operating under a double handicap, his blindness and the fact that Deering spoke only English. While his own English was good enough for general conversation the subject under discussion was both new and complex, and like any new technology there was a jargon to learn. Some of this concerned itself with spatial topology, with extra dimensions which could only be contemplated mathematically. And as an interesting personal side note Yoshio learned a little about the Gizmo's early development and how it had brought Adam and Marta together.

The story was bizarre. During experiments to create mirror image insect pests who would unsuccessfully try to breed with normal ones, then starve to death, Mike's wife had been murdered by a burglar who was stealing to support his dope habit. Determined to avenge her, Mike, aided by the adolescent Adam had turned the Gizmo against the dopers, flooding the market with mirror image drugs seized from jungle factories with the help of the Colombian army. It worked like nothing else ever had before. It broke the dopers and the dirty politicians who had been protecting them.

That had been a long time ago. Now, Yoshio had trouble equating the mild-mannered and somewhat portly physicist with such single-minded determination for anything but science.

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

"It's Wheeler's fault," Deering quipped. "He threw the idea of quantum foam out to us, and then he just dropped it. Of course, in his time the suggestion it might be provable by experiment would have been preposterous, but I'm convinced this is the how and the why of the Gizmo's operation. The theory postulates connections between each point in space and time with every other, but if these do exist it is almost certainly at the most fundamental level. By feeding enormous energy into the system we momentarily distort the conduits to permit the passage of larger objects, so we necessarily also distort nearby space." He stepped over to the blackboard. As computer literate as Mike was, and with all the electronic aids he had available, he still preferred that old standby.

For the next hour Yoshio listened to Deering's explanation and followed along as best he could, even though his sensor was incapable of resolving much of the symbolism. He finished with a slight headache, but with enough confidence in the technology described to him so that he did not fear his impending "surgery."

"You can have any color you want, Yoshio—brown, blue, green, gray, hazel, or any combination; take your pick."

"I think I'd better stick to the standard model, Adam. Brown goes better with my job, and I'd like a matched set. But I certainly would appreciate a little better focus than I get now." He chuckled—gallows humor, since with his sensor dismounted he got none at all.

"Lemme see what I can do, pal," Adam replied almost casually. He closed the chamber's hatch, flipped the switch that turned on the intercom he didn't need but which Mike, Yoshio, and the rest of the techs did, took his seat at the console and began the display sequence.

Yoshio's body had been thoroughly mapped already, of course, and this would be refined by many orders of magnitude when he made his first transmission through the Great Gizmo. But Adam took no chances. He had collected thousands of tissue samples, including some from the eyeballs themselves, and subjected these to every analytical technique he could think of. He was 99 and 99/100ths percent sure he could do what Yoshio had come to have done, but the remaining doubt disturbed him.

He took his time with the examination and spoke only when he noticed Mike, who sat at an adjoining console, was staring at him in bored anticipation. "Uh—you can start, Mike. I'm ready."

Mike turned to his flat-screened monitor, one last check to see that he had precisely the data needed, then began thumping keys.

Adam's screen segmented, displaying in tiny script the command sequence that Mike was now installing. Once keyed in, the system would automate, relying for control on the computer complex housed in the sub-basement beneath the three terminals and their matter bank.

The third terminal used a great deal of the file space, since it acted as the reversing buffer to rectify the mirror image effect. A mirror image human being would have been just as functional and healthy as the regular kind, but like the insects which had been their first ex-

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

perimental subjects he would have needed special foods. The additional terminal was one way of avoiding that problem. The second reversal could also be accomplished electronically but the programming that was necessary used up so much memory that this wasn't practical.

Suddenly, the Gizmo began to cycle. Simultaneously, the recording now displayed on Adam's screen began to scroll. Off its schematic representation thin slices of Yoshio's head began to peel off and disappear. The effect had been very unnerving to Adam the first time he had seen it. Glancing at his test subject he had half expected to see this happening in reality, but it was merely the computer's way of displaying the progress of its disintegration routine. When physical disintegration actually occurred, it happened all at once without even a puff of smoke.

Abruptly, it did. Yoshio's body disappeared from the left chamber, did not appear at all in the end chamber, and then after an interval of precisely 48.11189 seconds, it suddenly materialized in the middle chamber. An instant later that chamber's lock opened and a smiling Yoshio stepped out. "Some surgeon you are, Adam," he said in Japanese, "you cut yourself shaving this morning. I can see the nick."

"We did it," Adam announced, simultaneously in English and Japanese, "he can see just fine, but it didn't improve his manners any." Adam melted into the crowd converging on Yoshio and joined in the handshaking and hugging that followed.

"I have arranged for a small celebration," Marta announced. She had been stationed well out of the way while the operation was in progress, but afterwards had somehow managed to wiggle and worm her way into the very center of things.

This announcement was met with a cheer, and everybody, Gizmo techs and rubberneckers alike, eagerly followed Yoshio and Marta to the huge banquet room where the "small celebration" was waiting. Nobody gave another thought to the Gizmo. Like the Moor, the Gizmo had done its duty, just as it had always, and now could go. But this time there had been one small difference in its operation.

"Don't get me wrong, Adam, I'm not complaining. I really do like Yoshio, but I just thought—"

"That maybe it's time for him to go home and play with his own toys?"

"Well, yeh, maybe I do resent that a little. I haven't been able to find a way to suggest that gracefully. Uh . . . not that he's done anything really that bad, you understand, but—"

"He's upgraded your programming to the point where some of it's beyond you?"

"You know, Adam," Mike snarled, "sometimes having a conversation with a telepath can be a real chore. OK, look, how would you like it if some genius came along and did in weeks what it took you years to accomplish?"

"I probably wouldn't like it, Mike, but I don't see how you can say anything of the sort has happened. It was you who was the innovator. Before you built the Geewhizmo-Gizmo, having one was of no practical value, before you scaled

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

it up it couldn't directly benefit humanity. Now, I don't call innovations in programming an accomplishment equal to those breakthroughs."

Mike was glaring. "I'm not gonna let him use the big one, Adam. That's still experimental—still my baby, and its development stays under my firm control."

"M-Mike, I really don't see what the argument is about—where there's anything to stop you and Yoshio from being friends. You started out just fine, you seemed to like each other."

"He wasn't pushy then, Adam. Now he's all over me. He waltzes into my lab whenever he feels like it and fools around with my equipment and messes with my people."

"I'll talk to him, Mike, OK? Let me see if I can't head this off before it gets any worse."

"Try that if you like, Adam, but I'll tell you this, the guy changed, getting his vision back made him cocky. When are we going to announce that, anyway?"

"Why, I thought we all agreed about that, Mike—when our evaluation's finished and when we're satisfied there weren't any side effects. If we reveal all this prematurely we might be sorry. Once word gets out we can cure blindness you'd better have the Great Gizmo in good shape because it'll sure get a workout."

Adam paused, a particularly sober look appeared on his face. "Mike, I'm worried," he continued somberly.

"What?"

"I wasn't 100 percent sure before, now I am. You're right, Yoshio has changed, and a personality change could certainly qualify as a side effect. Marta and I need to study this some more—to be sure—we shouldn't simply blame it on the Gizmo without investigating; the Gizmo might not be responsible."

"Well now, that does change things, Adam. I'm sorry I climbed on you. I'll admit I never considered anything but physical effects. Uh—but he still stays away from the big one."

"Agreed."

The physical side of the scream was blood-curdling, and bad enough in its own way, but it was nothing compared with its psychic shadow. This hit Adam like a battering ram, at the very moment when the sound had wakened him and brought his normal preceptive apparatus into function. He jerked bolt upright, and was immediately enveloped in Marta's desperate grasp.

Her body was convulsing violently, her mind was a jumble of disconnected, uncollated sensory data. She could not think, nor could she project any cohesive, meaningful thoughts; except one horrible one that overpowered all else and burst through.

This was the one that now brought Adam as well into a violent fit of shivers—he caught its full impact, though he himself had not perceived it directly as she had. But he knew—someone had just died.

Adam struggled to roll off the bed, dragging Marta with him, striving to gain his feet and to shake her mind into some kind of order, but Marta was blocking him now, and wouldn't listen—she was dwelling on the macabre thought that had provoked her scream, not a healthy thing for a telepath to do.

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

Adam knew he had to shock her out of this before she did permanent damage. He slapped her, hard, again and again.

Finally she responded. The block came down and anger poured through. With both hands she flailed at his face, landing surprisingly hard and accurate punches.

Adam endured these without raising any defense, knowing that in a moment she would perceive his pain, stop, think, and understand what he had done, and why.

And in a moment she did. In that interval her attention was off the tragedy that had provoked the exchange and on the hurt they had inflicted on each other. Silent apologies passed both ways.

Then reality burst through again—"Yoshio," Marta shrieked.

Adam had not known who had died, how or where, or how Marta knew. Now, suddenly, her thoughts and recollections washed over his consciousness and he was privy to it all, and his own agony mounted as he gained one more fact—Mike Deering had been there, had probably committed murder; one of his good friends had killed another, this was the impression that Marta harbored.

Without a further word he snatched up a robe, as did Marta, and raced for the door. Their quarters adjoined their office, but were some 200 meters from the passage which led to the Great Gizmo chamber.

They arrived breathless, bursting through the door to find its travel partially blocked by Yoshio's body, lying face down, just inside the sill.

Mike Deering lay on his back farther into the chamber, a halo of blood around his head. He was alive but unconscious. Adam rushed to him and checked his vital signs. He could not tell how badly Mike was injured but he felt he was in no immediate danger of death.

"Yoshio has no pulse or heartbeat, Adam, and he isn't breathing," Marta mentally shouted, somehow having found the fortitude to touch his body.

Through her eyes Adam had seen enough to confirm that Yoshio was in fact, lifeless. The back of Yoshio's skull was a mass of tiny fractures. His brain was exposed and lacerated far beyond the skill of any surgeon to repair, and his neck was obviously broken. "Wake us up some help, Marta."

Adam used the interval to glance around the chamber. The Great Gizmo looked all right to him, none of the consoles were active, none of the screens were lit. There did not seem to be anything out of place or broken, despite the fact that a fatal battle had occurred here.

In a few minutes sleepy but willing hands transported Mike to Adam's lab. He had a fracture and a bad concussion, but was started on medication soon enough to prevent any dangerous swelling. Yoshio's body lay on a gurney beside Mike's bed and Adam struggled mightily to understand what had happened.

Copernicus Station had no police force, no guards, no security system, nor any developed procedure for dealing with crime. There never had been any crime, thus a need for such had never been anticipated. Even more awkward under the circumstances because it was a purely commercial venture, undertaken cooperatively by private enter-

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

prise, and no government officially claimed sovereignty over it. Copernicus station simply was. The best that Adam could do was instruct the lockkeepers, whose job it was to control entry to the Deering section, to close their lock and to keep the tragedy quiet until Adam had figured out what to do.

DeHart, the senior lockkeeper, had joined Adam and Marta in the lab. "Things are pinched off, Doc," he reported. "Nobody can get in or out, and I told the message center to clear all outside calls with you before they put any through. That'll hold things for a while—while it's 'night,' at least, but in the morning—" He didn't finish. Adam would draw the same conclusions as he.

"Thank you," Adam replied. "I wish I knew what to do next. Of all the things I could possibly have imagined nothing could be worse than this."

DeHart nodded sympathetically.

Adam could feel that intensely, and the thoughts reminded him that he had one more painful task to take care of. "Have the message center arrange a scrambled channel down to the US marshal at Matagorda, DeHart. Maybe he'll know what to do—if the US government has any claim to jurisdiction . . ." Adam left the thought unfinished. He didn't see how it could have, without a claim of sovereignty.

"Things are as bad as they can get, Marta. You 'heard'—everything depends on the state department and the Japanese foreign ministry. The Japanese government is understandably outraged over this but we have to do what we can to protect Mike. They want him, and our government agreed to surrender him, but I can get away with holding him here while he's comatose by claiming it would be dangerous to move him. That won't be forever."

"If he killed Yoshio, Adam . . ."

"We don't know that he did, Marta. Oh, I'll concede it looks bad, they weren't getting along, and the techs say someone had been fooling with the Great Gizmo, so there would have been motive. But you don't inflict a wound like Yoshio had with your bare hands, and if you're hurt as bad as Mike is you—"

"I see what you're getting at—and we didn't find a club or anything. If only I had awakened a few seconds before I did, or before Mike started raving, or before Yoshio died. . . ."

Adam ignored these lamentations. They'd already been through that. Marta had tapped just as Mike was going under, she had perceived a combination of amazement and rage which had suggested to her that he was in a homicidal frame of mind. There was simply no way to get any more out of it than that.

"Admittedly," Adam continued, clinging tenaciously to his subject, "You and I were busy, and it could have been something otherwise innocuous, something that wouldn't have been out of place in there."

"Both of them seem to have been hit from behind, Adam. That wouldn't be likely if they were fighting each other." That was a borrowed remark on Marta's part. She had filched it from Adam's errant speculation.

"In the condition he was in I don't think Mike would have had either the inclination or the strength to hide his

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

weapon if he had one. That implies a third party."

"Who, Adam? And why?"

"I don't know, but I'm glad I put a watch on that chamber when we took Yoshio and Mike out. At least when the marshal gets here he'll have an undisturbed scene to examine."

"OK, let's go over this again, Dr. Schoonover." Deputy Marshal John Allen was elderly, gray haired, spare to the point of emaciation, but sharp and perceptive. He was the law so far as expatriate US citizens were concerned, because of an old statute dating back to the days of skyjacking terrorists. But he was having trouble understanding how the crime had been discovered.

"I-I'm a light sleeper, Marshal," Marta volunteered. "Uh, and I, well, I sort of have a 'feel' for things. I can't explain it, but I knew instinctively something was wrong."

"Uh-huh. There was three hundred meters of rock between your bedroom and the scene of the murder, and several closed doors on the corridors, yet you heard something?"

"I said it was a feeling, Marshal. . . ."

"It's true, Marshal." Adam rushed to her aid. "Psychic phenomena do occur, and they operate in the same medium and on the same principals as some of our machinery here does. That's a scientific fact, and, what's more important, my wife is not your suspect, so leave her alone."

At this blistering riposte, the marshal backed off. "Well," he said, somewhat apologetically, "you have to understand skepticism goes with my job. I've got a lot of pressure on me. That 'Honor Guard' the Japanese government just landed—that's a whole platoon of imperial marines. They're touchy, and they're armed to the teeth with heavy-duty beamers."

Adam stepped over to the doorway, as though he might just see to it that the marshal couldn't leave the Gizmo chamber until the mystery was solved. Marta sensed this also, and crept to his side.

The marshal approached the door, stooped, and examined the bottom.

Adam instantly knew why but he had to wait for the man to say it.

"You said Prince Yoshio was lying at the door when you arrived?"

"Yes, he was."

"Looks like he clawed at the paint, Dr. Schoonover. Did you find any under his nails?"

"I didn't look for anything like that, but I think I'd probably have noticed."

"How about blood?"

"No, I'd have noticed that."

"Well, don't look like there was much, but whoever did this had bloody hands—I'd book it. There's not a whole lot of it, but there's definitely some traces on this knob. What about Deering?"

"No. Again, I'd have noticed a thing like that. But, that *is* peculiar." Adam was now firmly locked onto Allen's line of reasoning.

"It'd be pretty hard to bash two heads in without getting any blood on your hands, 'specially considering there's so much of it everywhere else. I betcha' if we checked some of the other doors around here we'd find more of it, provided all you people didn't wipe it off tramping in and out of here."

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

"We only did what was necessary, Marshal," Adam replied, somewhat offended. "We were trying to save a life, you know."

"Did the guy have any other enemies besides Deering?"

"None that we know of, Marshal, and I don't think you could call Mike his enemy—"

"Yeh, I can. I'm the marshal, and it's my job to do stuff like that." The marshal turned cold steel-blue eyes on Adam. "Of course, if your people were to find that club and if they were to obey my instructions about handling evidence, we might just find some nice clear prints on it and that'd take care of the problem."

But by then Adam, and Marta too, knew that the problem had just been compounded, though their posture demanded they let events follow a natural course.

Events did. DeHart burst into the chamber an instant later. "W-we found another body, Dr. Schoonover. I-it's Melinda Gomez. Somebody caved her roof in."

"Where?" The marshal yelled.

Without thinking how unexplainable this would be, Adam answered for the lockkeeper. "She's our storekeeper, at the warehouse, down the corridor from here."

"Lead the way, Dr. Schoonover. The rest of you people stay here."

Adam did, followed by the marshal and by DeHart.

"I told everybody to get out, Marshal," De Hart muttered, "so they wouldn't mess things up."

There was a lockkeeper at the door of the darkened room. He stepped aside to let the marshal in, and Adam flicked on the lights.

Melinda sat slumped face down over her terminal, blood still dripping off her chin into her lap.

"Did your people see or hear anything, DeHart?"

"Not a thing, Doc. Doc, she hasn't been dead very long, has she? I felt her—she's still warm. . . ."

"And still bleeding, Adam added. "Venous blood, draining from cranial vessels." He searched the nearby wall, examined a fleck. "A minimal amount of coagulation, the killer can't be very far away." *And why can't Marta and I read him*, he silently lamented. *Nobody could possibly mask this.*

"Everybody out," the marshal ordered, "except you, Doc, and you—what's your name?"

"DeHart."

"Right. The rest of you continue the search, but stay in touch with one another—don't anybody wander off alone."

He turned to Adam. "Now, Doc, the three of us will comb these aisles for clues.

"I think I see one already, Marshal." Adam stooped to examine a ragged looking blotch on the carpet runner that ended at Melinda's terminal. "I think that may be a footprint."

The marshal joined him, squinting. "Maybe, but it's not much help. It looks like somebody stepped in the blood and then wiped it off on the carpet. See how it's skuffed? Anyway, if this is a footprint it's too distorted to ever make a match. Anybody with feet that big, well, you'd know him, right?"

"Yes, I would, and yes it could have

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

happened that way," Adam agreed. Privately, another theory was emerging.

The marshal led the way around a tall stack of cartons resting on pallets the length of this enormous room. The first aisle appeared clear, as did the second, and every other aisle until they reached the far wall. Here things changed, some of the boxes appeared to be slightly out of alignment, not much, but enough so the two men gave that stack a closer look.

"What's this?" The marshal bent again, quite spryly for a man his obvious age, to examine a fragment of paper.

"Candy wrapper, Marshal. Somebody ate a candy bar. . . ."

Now the marshal was looking up and Adam had, of course, followed his thoughts, which by now were like neon lights. The marshal thought that somebody was on top of the stacks because he thought he saw a carton wiggle.

The neon lights went out as quickly as they had come on. The marshal reasoned that no murderer would stick around this close. Adam reasoned differently, knowing that the murderer might not have anyplace else to go and that the marshal thought like a grounder. He kept an eye on the tops of the stacks and let the marshal have the floor.

Farther down the same stack he found his next clue, another candy wrapper, this one wedged between two boxes at the top of the stack, immediately noticeable because it fluttered in the breeze of a nearby ventilator duct.

He said nothing to the marshal until they had completed the survey and returned to where Melinda's body lay, and then he made a suggestion. "There's one place we didn't look, Marshal."

"Yeh, Doc? Where's that?"

"Up there." He pointed up on the stacks.

"Not likely, Doc. I checked as we went. All the ladders are out of reach."

"You're forgetting where you are, Marshal. The ladders are useful if you're carrying something up or down but an athletic person without a load could jump high enough to get on top. The gravity is only one-sixth normal. Uh, have you got a gun?"

"Of course I have. I'm a cop, I got me a plazer." He drew the pencil-slim energy weapon from a shoulder holster under his jacket. "Wouldn't want to break the Bova Rule."

Adam breathed a sigh of relief, thankful that the Bova Rule banned slug-throwing weapons off Earth. He wondered if Allen had ever read the old master's story, about the embarrassing and dangerous persistance of bullets fired on the lunar surface. "Uh, I'll get us a ladder," he said somberly.

"The tops of the stacks are higher than the lights."

"The lights are on chains, Marshal, I can lift one up, OK?"

"I guess it won't hurt to look."

Adam muscled a ladder over to the first stack and positioned it for his climb. He then got another for the marshal, and placed it down the line, closer to the back wall. Then he mounted his and started up. He reached the top of the stack, grasped one of the hanging fluorescent fixtures, and by tipping it on its side managed to cast a wide beam of light across the tops of the boxes.

He swung it sideways, too. Just as the marshal reached the top of his ladder and drew his gun, Adam saw what he

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

was looking for, a curiously lumpy shadow cast against the back wall. It was not large but it didn't have the sharp lines the boxes made. "See that?" He pointed it out to the marshal.

"See what?"

"That lump. That's the murderer, lying flat under the tarpaulin covering that last stack along the wall."

"You don't say?"

"I'm serious. We have to get him down without getting anybody else hurt—except maybe him, that is."

Adam moved his ladder to the end stack and waited for the marshal to lean his against the one behind it. He did not ascend immediately but waited for a cue from Marta. When it came he scrambled up and immediately seized a hanging fixture.

Being nearer, he could manipulate it with more precision and easily picked out the lump again. The lump and its shadow suddenly moved, settling lower, a most extraordinary thing for a lump of that sort to do. "Can you see it, Marshal?"

"I can see him," the marshal answered, making a natural mistake.

"Fire a shot—don't hit it but come as close as you can."

"You mean, *miss on purpose?*" He said it like it was profanity.

"That's what I mean, Marshal. We want it to run. Don't worry, though, we'll be all right, and we'll catch it. Help has just arrived."

Allen's plazer sizzled. The responding shriek was ear-shattering. The lump sailed through the air and out of sight. They heard it strike the floor, and then they heard rapid footsteps as it ran for the doorway.

Adam scrambled down his ladder, tripped over the marshal, stopped to help him up, and thereby missed most of the action.

He was more fortunate than Marshal Allen was, however, and got a relay through Marta, who watched from behind the protective cordon of armed men.

The creature was lank, exoskeletal and six-limbed, without clothing but wearing an elaborate harness with many pouches in it. Adam could not read it, of course, since there was no common frame of reference. Its neurological organization was ganglionic, not chordate.

At the moment it was reaching desperately into one of the pouches, confronted by a circle of armed humans and well aware that it was trapped.

"Don't kill it!" Adam shouted out to the Japanese major, who stood with drawn sword in the center of the semicircle.

At that moment the creature withdrew its right front forelimb from the pouch. Something at the end of it seemed to open up like a flower and then the creature hurled a mass of yellowish powder at the men.

Screams rang out, studded with coughs, and the creature pressed its attack.

Adam watched in horror as these strange arms lashed out again, serated undersides pointed downward. He knew in that instant why they had found no weapon.

Two men fell beneath this assault, ripped open from gullet to groin. The snap of breaking bones was clearly audible.

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

Marta screamed, momentarily distracting Adam, who might otherwise have intervened once more.

In that moment the major apparently decided he had had enough. His sword was not an ornament, it was a weapon, and he used it. Tough as the creature's shell was it was no match for a samurai blade, made of the world's most perfect steel.

As if by magic the creature's thorax parted just above the second pair of limbs, then its head and the manipulative arms tumbled to the floor. Like an insect it still lived and continued to grope about for another handful of powder. The major split the head lengthwise with another blow, ending that segment's menace to his men.

Adam reached him at once. He quickly examined the marines who had been dusted and hurried them off to the nearest tap to flush the acid powder off with water. Except for those who got it in the eyes none were disabled. He didn't think its concentration had been very great.

The major was still staring down at the creature. "It is a monster," he exclaimed, over and over again. "This killed his highness."

"No, Major. It killed only one human being, Melinda Gomez. Prince Yoshio is not dead, that is, not permanently. Uh, at least this is what I think Mike Deering is going to tell us when he comes out of that coma."

"I do not understanding, Dr. Schoonover. We have Prince Yoshio's body under guard at this very moment."

"Believe me, Major," Adam replied, "I know it sounds like I've got a screw loose but I'd be willing to stake my reputation on it. I'd appreciate it if you'd contact your government and assure them that there have been some new developments that change the entire situation. At the very least, assure them that Mike didn't kill Yoshio."

"That is a reasonable request. I will do that. I-I would like to return later and examine the pieces, Dr. Schoonover —look!" He raised the samurai blade, surely as fine a weapon as ever existed. The formerly razor sharp edge was badly nicked.

"I will guarantee that you will have the opportunity, Major."

"I really am sorry you're still stuck with the sensor, Yoshio. I hope Adam can fix that soon." Nobody who heard Mike say that could have doubted his sincerity. Mike felt as badly as he said he did.

"That can wait," Yoshio assured him. "This isn't so bad, really. It would be a great deal worse if we tried without making modifications and if a swarm of those creatures got through."

"I agree," Adam added. "It may not be a serious danger—in fact, having it happen once was probably against all odds, but considering how physically powerful they are I think caution is in order."

"I can eventually program random materializations out of the system," Mike said. "Especially if I have some really competent help." He gave Yoshio a playful punch. "It's pretty obvious that we're the new boys on the block when it comes to understanding and using this, and that other races are far enough ahead of us to travel this way routinely."

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

"Ahead in other ways, too, I'll bet," Marta added grimly.

"That's the scary part," Mike said. "Somehow, entirely by accident, at the very moment Yoshio was supposed to materialize the Gizmo picked up this other, stronger signal and locked onto it. The passenger might have been anybody in that creature's society, probably was; an ordinary citizen, maybe a tired used-transporter salesman going home to the wife and kids, or a student on semester break, or a housewife returning home after a shopping spree."

"Why didn't we catch it, Mike? I mean, Adam and I—we couldn't read it, but . . ."

Shh! Marta.

OK, SORRY. "I mean, I get feelings about stuff like that," Marta continued, unsure whether Adam was sore at her or whether Yoshio caught her indiscretion. "You said if anything was wrong the machine would catch it—"

"The machine did catch it, Marta," Mike replied sheepishly, "but like any other computer once it executed the command it didn't bug us. And we were so anxious to go to the party and celebrate that we shut the Gizmo down without checking the monitor tapes. I should have done that. It would have saved me a lot of misery."

"When did you first suspect, Mike?"

"A whole lot later than I should have. At first, I figured Yoshio was just another spoiled prince who played the role of regular guy when he wanted something. Then I wondered why he hung around so long after he'd worn out his welcome, and finally I noticed that although he ate like a pig he got thinner and thinner. Also, he wouldn't stay away from the Gizmo even when I absolutely forbade him to monkey with it. And then it hit me—I was so excited when it happened that I completely ignored the obvious; all of a sudden I remembered he'd come out the middle terminal, not the end one."

"And you decided to run the Gizmo through a programming test?"

"Yep—and got myself brained for it. While I was at it Yoshio came in. I was too busy to watch him all the time and I couldn't stop so I threw caution to the winds, overrode, and dumped the buffer. This is when the creature materialized—in the end terminal. I couldn't move, I just sat there while the Gizmo cycled and turned itself off at the end of the test program.

"The creature attacked itself, that is to say it attacked the composite of itself and Yoshio. It must have been a very uneasy alliance to start with, but while its integrated self was in the buffer the creature had no choice but to use it. The alien intelligence must somehow have been the dominant part, and it directed its efforts to finding a way to getting home whole.

"That's what convinces me that it had a fair knowledge of transmatter engineering—otherwise it wouldn't have tried because it wouldn't have had any hope of succeeding.

"But it had another problem. It had a deadline. It would certainly have suspected the reason, having access to the same data Yoshio had. Coming out of the middle terminal meant it was reversed, something that, logically, Adam should have caught, except that like the rest of us Adam assumed things that weren't so. Yoshio looked all right and

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

claimed he felt good, and obviously he could see so—

"Anyway, while it starved, though as Adam says, this term means something different to a ganglionic creature than to a chordate, the composite waited for another opportunity. I alone can access the Great Gizmo's controls, the composite knew that, of course, and knew that it would have to grab the opportunity if I ever did it. It was clever enough to realize asking me to do it would just make me suspicious, consequently it was patient."

He paused and waited to see if anybody else was on the right track. Silence reigned.

"The Gizmo was on auto, running a test program that only I could override. If anything happened to me it would have to be rebooted, the composite knew that, too, but the newcomer didn't. Because it didn't it reacted recklessly, and attacked. I was its closest reachable enemy, so the thing took a whack at me and missed because the composite intervened. I think it's quite likely the composite was trying all along to explain its situation, because it was making strange unearthly cries that might have been speech, but the other one apparently wasn't convinced.

"Anyway, I saw the composite grab the creature by the hind legs and swing it around. On the bare floor that exoskeleton didn't have much traction and it went crashing into the door. It had trouble getting up, too, and it clawed at the door for a long time before it did. In the meantime I began to have my doubts about Yoshio. Having defended me he could be a friend after all. He helped me and I felt I had to help him overpower the creature, so I rushed over and tried to stomp the thing.

"It was too strong for us. It got up anyhow. It hit me a glancing blow and that's all I remember. Right after that it must have hit the composite squarely and killed it.

"Most likely it tried to activate the Gizmo and failed. It would have had the intelligence to realize that special skills were needed to do that, and that it must await its opportunity. This is what it did. If it hadn't killed Melinda it might have managed very nicely until it could escape, though of course it had no way of knowing that. Perhaps it was encouraged by the lack of an intensive search after it killed the composite and wounded me. Mayhem may be a normal part of its culture, just as it has been in some human cultures.

"Poor Melinda!" Marta sighed. "Why would it have considered Melinda a menace to itself?"

"She probably found all those candy wrappers it scattered around. She might even have been curious enough to get a ladder and look on top of the stacks. An intelligent creature would have interpreted this as both suspicious and threatening. Assuming, as it must have, that the presence of another dead body would not unduly upset humans it chose to eliminate the threat."

"It had a sweet tooth," Marta giggled. "So do I."

"Yes, you do," Adam remarked. "And if you don't watch it you'll be a little butter ball, but—the creature had a better reason than you do, its ganglionic organization is far less space efficient than a chordate system and despite the relegation of many lesser functions

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

to ancillary systems in other parts of its body, it still needed lots of cross connections with the head. You can only make a neck so thick without sacrificing mobility, especially within an exoskeleton, so every square millimeter available is important. Many earthly insects suffer from the same problem, and have solved it partly by drastically reducing the digestive apparatus. Like them, this creature may have been subjected to similar evolutionary pressures, with a resulting convergence, but my postmortem does seem to confirm that its gullet could pass only thin liquids."

"Like a spider," Marta shivered."

"Or an ant, or bee, or most any other insect; it dissolved the candy in saliva to eat it."

"I don't want to meet any more of them," Mike said. "Not under those conditions."

"Nor do I," Yoshio added grimly, "even if I never see again. It wouldn't be worth it to have that happen again."

"Have what happen?" Mike wanted to know. He could hear the snickers from Adam and Marta, who did know already, and he envied them the faculty that permitted them to upstage him.

"Why, to have to watch a swarm of these creatures tearing Tokyo to pieces," Yoshio replied soberly. "That's traditional alien behavior where I come from, you know, and I'm not 100 percent sure we have anything in inventory that could stop them. We'd need a super-hero."

"Adam," Marta giggled, "battling evil for truth, justice and the Amer—pardon me, the Japanese way."

"Adam and Evil?" Mike quipped. "Not bad!"

Then Mike's expression changed from the light-hearted to the somber, and the mood of the gathering followed. "Never!" He fairly bellowed. "Never! Yoshio, I hope you can stay a while. I need your head."

"You've got it, Friend." The hands went out and met and clasped firmly. Then a strange and worried look washed over Yoshio's face. "I wonder," he added, "what fail-safes these alien systems employ. Were they, perhaps, aware that a problem had arisen? Is it possible they might even be able to determine where?"

There followed a deep and ominous silence.

■

Editor's Note: This story is a sequel to the author's "Brainchild" (June 1982) and "A Slip of the Mind" (February 1984).

●I've learned to admit it when I'm scared because it takes courage to know when you ought to be afraid.

James Michener

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

the reference library

By Tom Easton

Soldier of Arete, Gene Wolfe, TOR, $17.95, 354 + x pp.
Castleview, Gene Wolfe, TOR, $19.95, 400 pp.
Dream Baby, Bruce McAllister, TOR, $18.95, 434 + xii pp.
Iris, William Barton and Michael Capobianco, Foundation Doubleday, $19.95 (hb), $8.95 (pb), 436 pp.
The Founder, Christopher Rowley, Ballantine/Del Rey, $3.95, 252 pp.
Mythology 101, Jody Lynn Nye, Warner/Questar, $?, 264 pp.
A Short, Sharp Shock, Kim Stanley Robinson, Mark V. Ziesing (P. O. Box 76, Shingletown, CA 96088), $45.00 (signed, limited edition), $18.00 (trade edition).
Astounding Days: A Science Fictional Autobiography, Arthur C. Clarke, Bantam, $8.95, 268 pp.
Invasion of the Body Snatchers, Don Siegel, director, Al LaValley, ed., Rutgers University Press, $32.00 (hb), $13.00 (pb), 230 + viii pp.

Gene Wolfe's *Soldier of the Mist* introduced us to quite a peculiar character, one Latro, a mercenary of classical Greece who, because of a head injury, must live his life one day at a time. When he sleeps, he forgets the previous day, with only a few minor, intriguing exceptions. He can also see such supernatural beings as the gods, talk with them, and do their bidding. Naturally enough, he yearns for the home of his childhood, for peace, for an intact mind.

Soldier of Arete is the sequel. *Arete* is Greek for "soldierly virtues," and indeed Latro is precisely the sort of soldier who plunges willingly into the fray, ready to die nobly but always avoiding that fate through formidable competence. He proves as much in the journey to Thrace in search of the man who roves the immense cables that stabilized the Persian "bridge of ships." There he and his companions meet Amazons, find their quarry awaiting sacrifice, steal the white horses of the sun for the Amazons, fight the Thracians, get their man, and escape, leaving political chaos in their wake. As their adventure nears its conclusion, the supernatural begins to coalesce around Latro—centaurs (or were-horses) come to his aid, ghosts follow him, goddesses assure him that he is invaluable to their schemes. And he himself, it seems, may be the Thracian war god personified.

Could it be? Is Latro a divinity in human form, forfeiting the memory of his origins in order to work out some Earthly plan or expiate some Heavenly sin? We've seen this idea before (remember Michael Lahey's *Quest for Apollo*?), and there are other signs that it may be the idea in Wolfe's mind. When Latro returns to Greece, a memory expert, perhaps aided by the goddess of memory, teaches him to build a palace in his head and attach memories to places in the palace. But in that palace, he meets a woman whom he later meets in the flesh—and she recalls him! He also meets a sphynx and learns something about the famous riddle and its relation to memory, and about the re-

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

lation of memory—especially written-down memory—to immortality.[1]

Greek politics push Latro toward Delphi to take part in the Pythian games (similar to the Olympics of the time). He understands what the oracle says—"Thou art royal, royal be"—though it is gibberish to all others. There, too, he finds a crew of captive Phoenicians who seem to know his true name and the name of his homeland.

And no, I won't tell you. Wolfe won't either, unless you think to use the glossary he so thoughtfully provides. I will hint only that one of the root cultures of modern Western civilization, at least around the time of Wolfe's tale (c. 400 B.C.E.), believed strongly in the ideal of the citizen soldier, the farmer who could when needed take up his sword and repel invading professionals. When the fighting is done, he abandons both his comrades and his memories of the time of battle and returns to the plough.

Will there be a third volume to the series, to dispel the mists? Wolfe leaves room for one, and certainly there are plenty of mists. Wolfe tells his tale from a very limited viewpoint, that of what a man of impaired memory chooses to record of his days and thoughts. If Latro mislays or is separated by events from his scroll, if he forgets to write, if the scroll is damaged, days and events, forces and motivations, are lost to us forever. Wolfe's faithfulness to his conceit makes the tale frustratingly opaque, but not so opaque that we cannot see, with care and attention, what Wolfe may be up to.

But Wolfe is a clever fellow, he is. Very clever. I *have* to say "may be."

More recently, Wolfe has produced **Castleview,** an Arthurian ghost story set in his native Illinois.

Does that sound unlikely? Remember how clever the fellow is. The tale begins when Will Shields, his wife Ann, and his daughter Mercedes arrive in the small town of Castleview. Will has just bought a car dealership, and the family is looking for a house. The realtor shows them one belonging to Tom Howard, his wife Sally and son Seth. Tom has just died, but that seems at first no more than a sad sidebar. The Shields family explores the house, and from the attic Will sees . . . What? The town bears its name because its people have for many years seen a castle, now far, now near, now to the east, now to the west, now clear, now shrouded in mists. Is it a mirage, specifically the sort known as a *fata morgana*? Is it delusion?

Ann, seeking the source of a strange horseman who plunged across the road in front of the Shields's car, finds a financially troubled girls' camp. Will, guided by one of his new employees, visits a local museum and finds much past history about the castle, and a link to the Arthurian mythos. Mercedes and Seth go off in pursuit of the castle and meet a man who, the astute reader will remember Wolfe said, is long dead. With him is a fey woman named Viviane Morgan. A strange little man appears and tries to buy the Howard house. A child crawls from an upper window in the same house into the castle. As the clues proliferate, an atmosphere builds that is as spooky as any I have ever seen, even though the cover blurb robs us of any surprise we might feel when we

[1]Not that Wolfe has anything to worry about. His tales are challenging enough in their density of allusion and metaphor to keep generations of graduate students busy. Alas, that very density may limit their long-term appeal to the general public. He will remain a revered figure for many years, perhaps even centuries, but I would be very surprised if his work remained popular in the same way as, say, that of Mark Twain or H. G. Wells.

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

learn that the castle belongs to Morgan Le Fay. It exists under the hill, in fairyland, and there is a price to pay for all those who would escape.

Spooky, yes. Excellent in atmosphere and setting and plot. But still I found it less worthy than most of Wolfe's work. The people he focuses on are wooden—they live, they have pasts that make them seem almost real, but they respond far too prosaically to death and the intrusions of weirdness that give the story its atmosphere. They are emotionally flat, and this makes the tale far less convincing than it might have been. Perhaps, I tell myself, Wolfe wrote it as self-entertainment, as relief from the strain of creating the *Soldier* books. He thus did not give it all his energy, and it does not show all his genius.

Or am I being unfair? If you think about it, Wolfe often does keep his characters —Severian of the *Urth* series, Latro of the *Soldiers*—at arm's length. He constructs his stories as if they were elaborate dioramas and invites you to admire the effect. Where many writers invite you to live in the worlds they create (consider the McAllister book reviewed next), Wolfe does not, or does to a much smaller degree.

Perhaps, then, the problem is simply that his style works less well when he chooses to set a story in a more contemporary setting, a story in which we *expect* to be able to live.

It's a long time between novels for Bruce McAllister, but it's worth the wait. His first one, *Humanity Prime,* came out in 1971. Now we have **Dream Baby,** based on a 1987 novelette, and it is a gorgeously compelling fantasy of war and wild talents.

The time of the story is the early seventies. The setting is the Vietnam war, where people routinely come close to death, a situation rumored to awaken strange abilities in the service of survival. Some people see their mothers or supernatural beings pointing out booby traps. Others see some mark of death on those who will soon buy the farm. Some learn to hear the thoughts of others and thus to move away from wherever a gun is pointing or to shoot those who are prepared to shoot them. For some, such as Steve Balsam, time slows so they can dodge bullets. For nurse Mary Damico, stressed out by the constant exposure to blood, mutilation, and death, the miracle is prescient dreams of those whom she may not meet for hours, days, or longer. At first, the dreams let her comfort patients with news of home and a sense of being known, understood, loved. But those she comforts all die. She is going quickly mad when she meets Steve Balsam; Steve tells his chief, Bucannon, of her, and Bucannon yanks her out of her nursing gig to a strange jungle camp where, she soon learns, there are many who have talents as strange as her own. Bucannon is studying these people, fascinated by the ways the talents help their possessors and sometimes those around them survive patrols and other missions, and looking for more ambitious ways to use them in the war.

Sadly, Bucannon is a heartless bastard who has no compunctions about testing his human anomalies to destruction. He wants to know just how much they can survive, and he is satisfied no matter what the outcome. Win, lose, or draw, he can always learn something. This does not sit well with Mary, but she is helpless. When Bucannon finally sends her, Steve, and several others on a mission deep into North Vietnam, there to use a cache of explosives abandoned by the French to blow the dikes that preserve the north from vast floods,

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

she is pervaded by a sense of doom. Her dreams tell her that Steve and all the rest will twitch away their lives on the muddy shore of a northern river, surrounded by northern soldiers, pummeled by too many bullets to dodge. Yet she must obey orders, and Steve assures her that even if doom seems inevitable, the chance of ending the war makes the attempt worthwhile.

Does it? To McAllister, it seems that any attempt to *prevent* war, however risky, however longshot, is what is most worthwhile. If the US had frowned upon the French way back when, if the US had offered Ho Chi Minh aid and thus prevented Ho's turn toward the USSR, if and if and if. It is perhaps not surprising that at the end *Dream Baby* shatters into such a confused vision of alternate realities that we are no longer sure whether the novel occurs in our world or another.

McAllister knows the forces at work in Southeast Asia. He has immersed himself in the history of the region. His sense of setting, of geography and climate and people, seems impeccable. He gives us a fictive world that seems as real as our own, one so hot that we sweat as we read, so rainy that we feel wet, so violent that we look for blood on our own skin. And, the publisher assures us, "The CIA project on combat-induced ESP experiences was real. Somebody really did go through these events." Some of them, at least.

Don't miss this one.

According to William Barton and Michael Capobianco, a century or so hence a wandering gas giant, beringed and bemooned, will approach the solar system. "Asterologists" will name the new world Iris and marvel at its strangeness. Yet they will know hardly anything of just how strange it is. The full truth is reserved for the characters of Barton's and Capobianco's novel, **Iris,** a first novel that promises much for the authors' futures.

Iris's characters are a strange group, drawn together by John Cornwell, a wealthy musician who has decided it would be nifty to set up a colony on Neptune's moon Triton. He has collected Brendan Sealock, scientist, engineer, boxer; Achmet Aziz el-Tabari, the artist self-named Demogorgon; Jana Li Hu, asterologist; Harmon Prynne; Aksinia Ockels; Vana Berenguer; and Temujin Krzakwa. Their ship is on its way to Triton when the discovery of Iris is announced. They decide to change course, to be the first to reach Iris, to set up housekeeping there instead of on Triton. Quixotic they are, filled with dreams and fantasies in a way that is only underlined by the way they plug their brains into their computers and construct new realities.[2]

They reach Iris, set up their base on the moon Ocypete, and find anomalies, beginning with the appearance of melting around their base, on a moon that has never been far from zero absolute. The second anomaly is buried within a second moon, and it is an anomaly indeed: a miles-long lifting body, a colossal landing craft, in partial working order. When they assemble a suitable scanner, they find a third anomaly within Iris itself, and this is the biggest of all: the lander's mother ship. And within this ship something is alive enough to strip Sealock's mind from his body.

This being science fiction, problems have solutions, but I won't spoil the tale for you by giving too many hints. In fact, I'll shift gears and talk about *Iris*'s

[2]This is in fact the key to both Cornwell's music and Demogorgon's art.

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

other story, the people. The tale's characters begin as so many isolates struggling to make contact with each other. This is why they signed on for the voyage to Triton in the first place. This is what drives their frenetic sexual activity. (It is also what keeps all the sex from becoming even mildly erotic; I found it astonishing just how drearily such activity could be portrayed, presumably deliberately.) This is what drives Demogorgon to entice others into his shared-world computerized art.

We see the struggle again and again in the memories the characters offer us. They share pasts of rejection and seeking, and the novel continues the shared theme until . . . It's SF. There has to be a solution. Surely, says the astute reader, the two problems will share a single solution. And so they do, with the ultimate point being that isolation ends in the sharing of pasts, of memories. Only then can one be liberated to seek one's destiny.

That should be cryptic enough.

The last of Christopher Rowley's books to come my way was *The Vang*. Before that were *The War for Eternity* and *The Black Ship*, both of his "Fenrille" saga, concerning a far-distant world settled by humans fleeing a Stalinist-socialist tyranny on Earth. Fenrille has natives, the fein, and its single ring-around-the-collar continent is dominated by gigantic trees. There are fierce insects, the chitin, which produce a valuable drug. There are the woodwose, enormous humanoids that protect the forest. There are . . .

But those are all items of the future, as far as Rowley's current book goes. It's **The Founder,** and it concerns the flight of the settlers from our Solar System. Begin with the Fundans, a clan of technocratic tycoons, builders of habitats and other high-tech gadgets. The old man of the clan, Edward, has a dream—the *Founder*, a massive spaceship capable of taking to the stars those who can see poverty-stricken Earth's social tyranny closing in on the wealthy settlements of Sol's outer planets and habitats. But the old man's son is a spineless, visionless ne'er-do-well. Edward takes in hand his grandson, Dane, educates him, teaches him the dream, gives him the skills of finance and engineering and management he will need.

Then the old man dies, poisoned by conservative opponents among his kin. His will is set aside. Dane must scramble to finish the ship, and when the money runs out, he must go to his clan's enemies, the Arab-descended Khalifi. They are callous, greedy, mean-spirited, and cruel, yet some have vision.[3] When the Fundan *Founder* finally launches, the Khalifi are aboard. Quite promptly, they take over control, banishing the Fundans to steerage and enslaving whomever they wish. Dane Fundan goes mad and disappears. In due time, the ship reaches Fenrille and the destruction of the forest and the construction of Khalifi palaces begins. The woodwose awaken, outraged by the insult to their home. And then . . .

Remember: The other Fenrille books have precious few Arabs. They also tell us that there are survivors, and even—as I dimly recall—that the Fundan name continues.

Is *The Founder* any good? Overall, it's quite readable, but I don't think it's a match for Rowley's earlier books. In fact, I suspect the author here gives us something he couldn't sell until he had established a reputation—that is, the other books are better because he wrote

[3]Thus might we also describe Libya's Ghadafy or Iran's Khomeini. I suspect Rowley designed the name of his villains with quite malicious forethought.

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

them later. This one is simplistic and melodramatic. There's an annoying amount of maid-and-butler dialogue.[4] And most of the situations, characters, and settings smell a bit musty, as if they have been sitting around the prop closet for a few too many years.

Jody Lynn Nye's **Mythology 101** offers us an Illinois university beneath whose antique library lives a colony of pointed-eared, magical midgets—or elves—refugees from several European venues who speak in as many accents—Irish, German, Yiddish. They live by scavenging (remember the Borrowers?) with the aid of a few human sympathizers, whom the master of the colony rewards by teaching courses rather better than the conventional professors above the ground can manage. Those students who need the most help occasionally find their way to the secret classroom "under the hill" and gain great benefit.

The irrepressibly rambunctious Keith Doyle goes gaga over Marcy Collier and follows her to the secret class. He is accepted, finds the benefits, and learns that his efforts to have the library—instead of the gym— replaced by a modern building will do untold damage to his new friends. He finds hope in selling elf-made crafts, finds a new girlfriend, exposes the oaf who is selling elf stories to the tabloids, gets in trouble with the local union boss and the IRS, squeaks through again and again, and finally . . . Like most such tales of step and misstep and stumble through, all ends happily, of course.

The tale has its charms, but taken all in all, it doesn't really have much to recommend it. It is far too obviously written for an audience with a limited taste for originality. It's the literary equivalent of popcorn: light and amusing and challenging neither the tastebuds nor the digestion. Nor does it hold any hazard of provoking strenuous mental activity, unless you are the sort who notices when a "contemporary" novelist doesn't seem to be aware that today even kids have to have Social Security numbers.[5]

Some of you object to the way I go off-trail from time to time with various small-press items. I do it for three reasons: First, to tell you about worthwhile or interesting items you may not otherwise hear of or run into; second, to give the small presses the sort of boost they need to survive and—where necessary—improve; and third, because these items give me—and you—a valuable sense of what is happening in SF away from the mass-market scene dominated by just ten major publishers.[6]

Naturally, I'm leading up to another small-press item: Kim Stanley Robinson's **A Short, Sharp Shock** comes from Mark V. Ziesing, and it is one strange novella. Don't expect plausibility as the protagonist, Thel, awakens in the sea, tumbled like agrunion onto the beach with a woman at his side. Come morning, the woman is gone, taken for sacrifice by the spine kings, say fisherfolk who seem made of seaweed. And Thel is off, to learn that the world is a long, narrow ribbon of land, the spine, surrounded by sea; it may encircle the globe. He falls in with a tribe of tree people, who have small trees growing

[4]In which characters tell each other things they already know, for the benefit of the reader.

[5]Maybe—since I'm reacting to galley proofs—that particular gaffe won't be in the book you buy. But don't bet on it.

[6]Ace, Bantam/Foundation/Doubleday, Warner/Questar, NAL/Signet/ROC, TOR, Ballantine/Del Rey, DAW, Avon, Baen, and Morrow.

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

from their shoulders. He finds the spine kings, rescues his friend, and flees, finding strange friends, arbitrary pleasures, temporary presents. Robinson's moral may be that this is life.

The flavor—fancifully stark, heavily symbolic, tasting most perhaps of absurdist theater—is reminiscent of Stephen King's *Gunslinger* series.

I can hardly pass up reviewing Arthur C. Clarke's **Astounding Days: A Science Fictional Autobiography,** can I? Not with a title like that, which reflects an endearing focus on this very magazine. It was the March 1930 *Astounding* that was the first SF magazine Clarke ever acquired, at the golden age of 13. His involvement with our favorite literature is thus just about as old as the magazine, and the development of the two, individual and institution, followed parallel tracks for many years. Clarke began by doing his best to build up a complete run of *Astounding* despite problems of adolescent penury and peculiar trans-Atlantic shipment schedules. In due time, speaking for the British Interplanetary Society, he wrote to John W. Campbell, Jr. In April 1946, he sold Campbell his first story and began a long and familiar career.

The book tells it all, landmarking the years with those *Astounding* (and other) stories which for one reason or another stuck in his memory. As he discusses the stories, he tells us where the authors seemed particularly prescient, as well as where they committed egregious gaffes.

If much of the story seems familiar, well, the past few years have seen several books that featured the magazine in one way or another. The reason is simple: *Amazing,* the only remaining magazine of similar vintage, has been so moribund for so many years that it is of interest only to antiquaries. *Astounding* has displayed such an astoundingly vigorous longevity that it is still widely read as those deans of SF who began their careers at about the time of its birth reach the age for autobiographies. And it grew a lot of deans, in large part thanks to Campbell.

Is Clarke done yet? Not hardly. I have in the pile of books awaiting my attention *Rama II,* the sequel to *Rendezvous with Rama,* produced as a collaboration with Gentry Lee. I wasn't entirely happy with the last such collaboration, but I'm still looking forward to reading this one Real Soon Now.

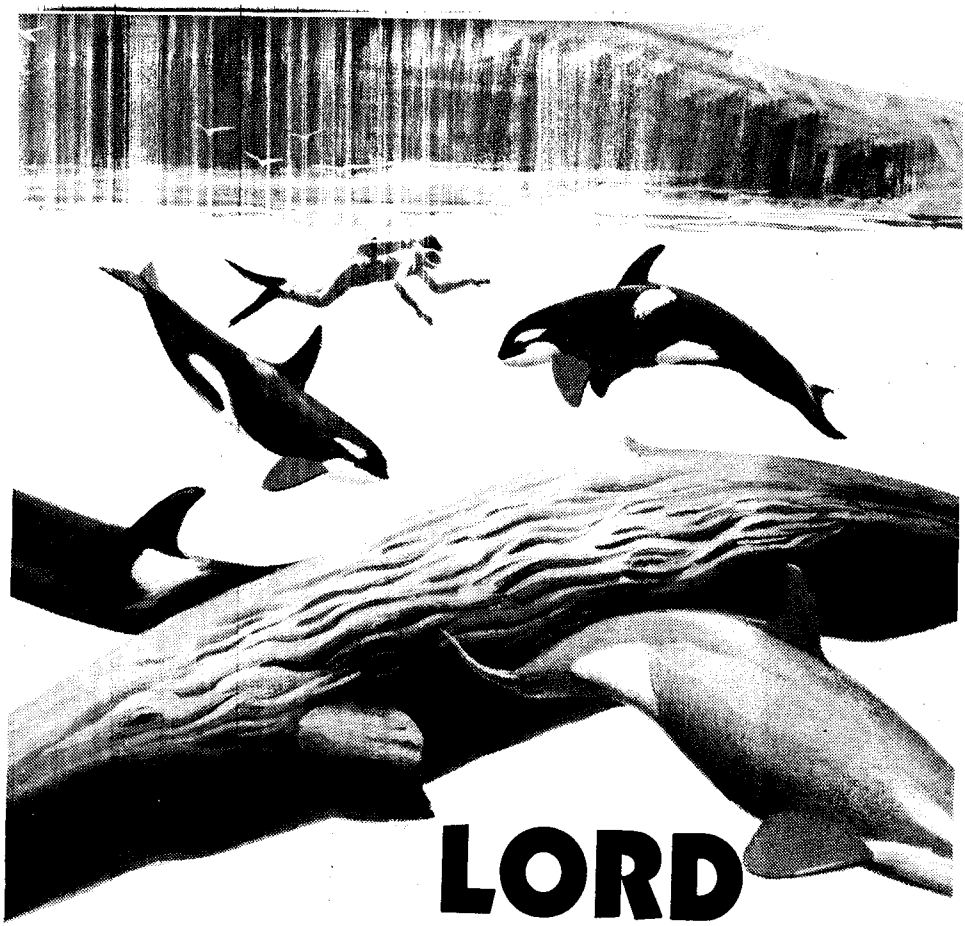
Film fans, rejoice! Rutgers University Press offers you "the first and only Science Fiction book in the 'Rutgers Films in Print' series": **Invasion of the Body Snatchers.** The original B movie, released in 1956, was directed by Don Siegel from a screenplay by Daniel Mainwaring after Jack Finney's 1954 *Collier's* serial, *The Body Snatchers.* It was, says the publisher, "long admired for its energy and sophistication" and considered "controversial... frequently interpreted as a major picture of American cold war fears." This book, assembled by Al LaValley, includes the movie's script, postproduction memos, related interviews, reviews, and commentaries, and an introduction in which LaValley shows "how the ambiguous politics of the film came about and how it was largely intended as a protest against 1950s American conformity, and not as an anti-Communist document."

The book's greatest value may be to remind us that interpretations of film and fiction (and more) depend on the hopes, fears, and ideologies the interpreters carry in their heads, at least as much as on the actual content or intent of the work interpreted. ■

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

Vincent Di Fate

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED



LORD OF FISHES

Bernard Deitchman

Beings who exploit other beings need to remember the difference between an employee and a tool. . . .

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

Even as the eagles are lords among the lightsome birds or lions amid ravenous wild beasts, as serpents are most excellent among reptiles, so are dolphins leaders among fishes. Them as they come no fish dares to approach nor any to look them in the face, but they tremble from afar at the dread leaps and snorting breath of the lord of fishes.

Oppian of Corycus, *Halieutica*

I

The rocky beach was at the base of a cliff a thousand feet high. In summer, the Sun was at its zenith when it passed the edge of the cliff, and in winter it was visible three or four hours a day. Few people would have chosen to live here, and from David Edel's house fifty feet above the beach his nearest neighbors were miles away in either direction. There was a well-traveled highway, California One, that passed only seven hundred feet from his door, but it passed unseen and unheard, the seven hundred feet being straight up. Visitors seldom came down the steep dirt road to the house, and they were all invited.

The sea itself was deserted. Fishing boats and tankers kept far offshore, beyond the horizon. It was the perfect place for someone like him, as even his parole officer agreed, and on days when radio traffic got heavy on the emergency frequencies and the coast guard or the Navy invaded the area, Edel was relieved to know that the emergency was someone else's—a lost, drunken pleasure boater's, usually—and that *Federales* were not chasing him.

At times like the present, though, when a really big search got rolling, with the local planes and cutter from Monterey being joined by cutters from Morro Bay and Santa Barbara, Edel felt restless, as if he had become too much a spectator. Life was routine. He walked along the rocks every afternoon, and inspected the tidepools and beds of anemones and mussels. He knew the starfish and octopi who lived along the rocks, and all the otters. In season, he took his inflatable boat out to visit with the gray whales during their migrations, and sometimes saw porpoises.

His mornings were spent reading, or on the road, either to Big Sur to buy food or to Cambria to visit the library. Nights he could imagine he was on the edge of the world, when the ocean and Moon—if there was any Moon west of the cliff—disappeared in the fog bank that drifted to shore after sunset. For several weeks the previous summer, the sea had warmed enough to dispel the fog and breed a red tide, the most beautiful and by far the strangest phenomenon he had ever seen in nature. The upper ocean swarmed with bioluminescent micro-organisms that emitted an eerie, blue-white light wherever a wave or whitecap broke and disturbed them, and at night the surface looked like a vast plain of sparks and fires and sheets of lightning. Until the water cooled and the fog came back, he stayed up late, or all night, to watch, and slept in the morning.

Since the red tide, nothing had interfered with his habits, though the second morning of the current search, when he should have been on the road south, he

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

stayed home to monitor the radio. The swabbies were reticent using the normal channels, and he suspected they kept to the high-speed channels, the ones submarines used, for explicit talk. Nonetheless, he could tell from the range of the search and the resources committed to it that what they were after was something more important than a weekend captain, and he stayed home the next day, too, and watched the sea expectantly for debris, or survivors of a shipwreck. What he finally saw when the fog burned off was a fleet of dorsal fins out beyond the breakers.

The height of the fins in relation to their distance did not immediately register, and he assumed he was looking at a school of sharks. But no shark had a fin that sharp and narrow, or—as Edel realized when he got the distance correct—a fin as tall as a man. And of course no shark would surface with an exhalation of vapor and an explosive "Whoooo-uuuuuuh!" that echoed off the cliff.

"Orcas," he said aloud. "Unbelievable!"

He ran down to where he kept his inflatable boat. Eight, nine, ten more blows. At least that many animals were in the pod, probably more, as some were always beneath the surface. He put on a wet suit, tossed a face mask, weight belt and snorkel into the inflatable, and headed into the surf. He rowed through the wash from the breakers until the water was deep enough for his engine. As it drove him past the breakers, he could see that the orcas had moved closer to land, and were circling, as if they were fishing.

In calm water, he cut the engine. He knew how much noise bothered dolphins, and the last thing he wanted was to drive them away. They paid no attention to him, all of them diving and surfacing one after the other, either playing or fishing. No, not all of them were diving. Two fins stayed on the surface, quite close together, while the others circled around them. He rowed closer. He had to see what they were up to, and, more importantly, he had not been in the company of dolphins —which orcas were, despite their more common name of killer whale—for more than a year.

He had never been in the water with orcas, but he felt no fear of them. Certainly they were the aquatic equivalent of a pride of lions, preying on any animal in their domain worth the trouble without fear of being eaten themselves, except by *Homo sapiens*. But as if to acknowledge that unique human power, the largest predator by far on the planet—despite a reputation in folklore as a man-eater—had never, not even to sample the taste, put a tooth in human flesh. And there was more to it than a preference for fish. Orcas would gobble up ducks and gulls napping on the ocean surface, kill seals and sea lions sunning themselves on rocks, and try to snatch dogs from boats or beaches. Their restraint with humans intrigued Edel. Was it the respect of one sentient creature for another, or simply that of one brutal predator for another even more brutal?

Their behavior would remain a puzzle until the day humans learned to decipher their language, the complex signals they whistled and squeaked and sang to each other, the noises he heard in person for the first time as he drew closer and

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

closer to the circling pod. A computer might make such noises to itself, he thought.

"Kwwweeeee—skweeeee—eeeee—"

He paused, put his face mask on and stuck his head in the water. North Pacific water, as cold as orcas liked it. His own skin contracted at the touch. Then he heard the echolocation clicks coming so fast they hummed off the bottom of the boat like the sound of a geiger counter in a radium mine. The orcas had their sonar on him.

He came up for air. The two animals at the center of the circle had turned toward him, and the others opened the circle for them to pass. The nearest animals were only ten yards away, the upper parts of their bodies sliding in and out of the water like the hulls of submarines, their dorsal fins cutting the air like the sails. Edel's boat rocked in their wakes, and he laughed and said hello to them. He was sure he could walk around the circle, from the back of one animal to the next, if they would let him.

Then he noticed the collars. Every one of the orcas had a thin gray strap looped around its body immediately behind the dorsal fin, with a second loop around the base of the fin itself. Attached to the base loop behind the fin was a small gray packet Edel guessed was a radio transmitter, to track the animal's movements. The set-up was unobtrusive and the animals were probably used to it, but now he seriously wanted to make a tour of the circle, to get the collars off.

He searched the boat's storage compartments, found no tools to cut with. If he could get a look at the collars, though, he might figure out how they were locked on, and unlock them. In the process, he would learn how much of his attention orcas would tolerate. They were dolphins as truly as a happy-go-lucky bottlenose was, but a Doberman and a Dachshund were both dogs, too. Still, he had known a lot of dolphins.

At the age of twelve, he and his parents had gone to Florida to see a school of spotted dolphins that came to play in the shallows around one of the Keys, and allowed humans to touch and play with them. His parents had no formal education in science, but were amateur naturalists who knew the names and uses of plants, the habits of animals and the concept of ecology long before it was a political catch-phrase. The trip to Florida was the perfect vacation to them, and the origin of their son's life of crime.

The dolphins had taken children, including young David, for short, fast rides on their backs. His first ride he had been hesitant about trusting the animal, but then the speed of the ride, and the obvious joy the dolphin took in its play, exhilarated him. He had ridden several dolphins a total of fourteen times, and one ride in particular settled his career.

The dolphins carried their riders three or four hundred feet off-shore, where the sandy bottom was still perfectly visible through the clear water, and David watched it for shipwrecks and sunken treasure. What he saw instead was a long, moving shadow, followed by the huge shark that cast it. Not knowing that dolphins routinely kill or injure sharks that threaten them, he had trembled with

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

fear and almost cried out to his parents. But they were too far away to help him, and so he clung to his dolphin and hoped the shark would not notice them. The dolphin, as if sensing his fear, rattled off a burst of popping noises like firecrackers. The shark spun around, turned its grotesque head upward, saw the dolphin and sped away. Laughing, David stroked the dolphin's head. His playmate and now protector, equally pleased by the outcome of his challenge, splashed and leaped toward shore. The superstitious twelve-year-old decided this was proof he bore a mark, a blessing, the spotter—and any other dolphin—could recognize to show he was a friend. Twenty years later, though he could appreciate his irrationality, he still believed it. He would trust these animals with his life, too.

He rowed slowly toward the pair that swam together. They were two of the biggest orcas, about twice as long as the inflatable. Twenty-five feet, nose to flukes. At that size, they were obviously males. Now that they were separated from the rest of the pod, they lay almost motionless in the water. Edel turned his boat so that he approached them head-on, to give both their eyes and their sonar a good look at him. From that angle he could see that they were inches apart, and cradling a small, smooth, dark object between them, holding it above the water with their flippers.

A calf, he thought. Probably sick, or dead. Dolphins would support still-born calves so their blowholes were in the air, sometimes for days, and that might be what was happening here. Of course, if the calf were alive—

"Yeah, what?" he said aloud. The only transportation up the cliff would involve a Navy copter that had a dolphin sling, from the cetacean project down south. If they brought the calf back to health, they might keep it.

He was close enough to catch some of the spray from the males' blowholes as they breathed, and he heard in their exhalations the hollow tone of wind in a tunnel, testimony to the great volume of air in their lungs. They lifted their flippers slightly and he saw he did not have to worry about rescuing a calf. What lay between them was a human being in a black wetsuit, looking thoroughly dead.

Besides insulation, a wetsuit also provides buoyancy. As the body carried no weights, it might have floated without support, but the orcas would not release it, so Edel said, "You want me to look at your friend? You'll have to let me up on your backs."

Motionless as they were, the orcas already seemed to know that. Edel spoke to them not to communicate meaning, but because sound was the most important way they sensed their surroundings, and they needed to hear what he sounded like.

He rowed alongside them. The tips of their dorsal fins were eight or nine feet above him. Like talismanic markings, the perfectly streamlined segments of white on their black bodies—the eye patch, the saddle patch behind the dorsal fin, the rising and falling curve of the belly—emphasized the powerful mass of the animals. If an ordinary six-foot dolphin like a spotter could impress him as a protector, Edel understood now why Indians in the Northwest considered the orca a supernatural being, a

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

spirit creature whom they would not hunt for fear of angering it.

He took hold of the collar of the animal beside him. It felt like nylon. He twisted it around, looking for markings to identify the people who put it there. Nothing. He tied the inflatable's mooring line to the collar, and carefully touched the orca's skin. It was silken smooth. He reached for the radio box. If he could not cut the collar, he could at least disable the transmitter.

But when he opened the box, it was empty, except for a pair of dangling wires and a broken plastic mount. He smiled. "Somebody does good work," he said. Looking at the corpse—a man's body, from the width of the shoulders—he added, "And really paid the price."

Balancing against the dorsal fin, he climbed up to the orca's back, and knelt on the skin forward of the fin. This part of the animal was not smooth, but ridged with scratches, all of them long-healed and probably self-inflicted. Most larger cetaceans had them, from rubbing against bottom rocks to remove parasites. The orca sank a bit, and a wave covered its blowhole for an instant. It blew, showering water on him, and took in extra air to compensate for his weight. Its breath was slightly saline, the smell of steamed fish. The other animal blew, and Edel said, "Good morning to you, too."

They heard him, though he was sure his voice was hopelessly slow and bass to them. One emitted a squeaky sort of rubbing noise from its blowhole. The animal he was not riding rolled over so that its left eye was looking straight up at him, and he looked back. The language barrier, questions forever unanswered, frustrated him. All he could hope they understood was that he and they were on the same side of the war that had cost their friend his life.

The orca returned to its usual swimming position. Edel reached down and tried to lift the corpse. Water-logged, it was dead weight for a fact. He managed to pull it up on his orca's back only because both animals raised their flippers to help.

There was an inch-wide hole in the back of the wetsuit, and when he turned the man over, another in the chest, noticeably higher. Death by gunshot, with the killer in front of and several feet above the victim, or behind and below the victim.

The wetsuit was a standard civilian type, and anyway the man's hair was too long for a GI's. No, this was definitely one of the good guys, and the bad guys had started playing rough. Soaked, the man's hair covered the upper part of his face, and Edel did not look closely at the rest. He did notice that both feet and hands were bare, and intact. That meant the orcas had been protecting the body from sharks since the shooting, and had witnessed it.

"I do wish we could exchange a few words," he said to them. He wrestled the corpse across his orca's back and let it slide into the inflatable. Then he reached over to the other orca, and, resting one foot on each animal's flank like a stunt rider, opened its radio packet. This one also was empty.

"He did a thorough job, didn't he? You bet."

He returned to the first animal. The

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

other let out a long, fading whistle, inhaled and sounded.

His mount made no attempt to follow it, but did start to move, slowly and toward the open sea. Edel noticed that the rest of the orcas were already fifty or sixty yards out. Sadly, he knew he had to leave. He scratched the orca's head and it made a rubbing noise in response. He grabbed the harness for balance, said, "You come around again and I'll cut this crap off you," and slid into his boat. He untied the mooring line. After a few deep breaths, the orca slid beneath the surface, its flukes leaving a wide, swirling wake behind.

He had a moment to feel abandoned before the ocean between himself and the pod parted with a rush, and a blow like a cannon blast. A fountain of spray blew high at a sharp angle. A strong, almost meaty smell of warm breath followed it, and—if the day had not been extraordinary enough—a whale appeared in the midst of the pod. Not merely a California gray, this was a *whale*, the real thing, maybe sixty feet of it. Jonah's taxicab. Exhaling a second time, it leaped part-way out of the water and revealed a massive square forehead. A sperm whale. Then it slammed down, its flukes slapping the surface and raising waves that rocked the orcas.

Orcas. Killer whales. Edel's amazement turned to fear. He thought the whale's sonar had failed it, put it in a death trap, and it was panicking as it saw the orcas. But nothing happened, except that the whale slapped the water a few more times and the orcas circled around it, whistling and squealing. Greeting it.

They were fellow travelers. The lions were swimming with the lamb, or escorting it, for they stayed with it as it expelled several more breaths, and then everyone sounded at the same time. Edel stared across the empty ocean and wondered if anyone would believe what he had seen.

Some people in the Navy would. They, not God, had convinced predators and prey to forget millions of years of instinctive fear and slaughter, as earlier domesticators had trained dogs descended from wolves to herd rather than hunt sheep and cattle. Only what was the purpose here?

He waited, but they had moved quickly beyond the range of sea-level vision, probably to feed, because a sperm whale hunted animals that lived deep. It would get hungry in these shallows. Edel started the engine and ferried his grim cargo to shore.

He left the boat on the beach and climbed to the first switchback of his road. From there he could see miles, to the fog bank on the horizon, and after a while he saw the distinctive forward blow of the whale, and that was all.

II

The beach was in sunlight when Edel came down to it and gingerly unloaded the inflatable. The body hit the pebbled ground with an unpleasant, watery sound, face down. Edel would have liked to bury it immediately, but curiosity got the better of him. Experienced divers carried medical ID cards, listing blood type, allergies, and other emergency data. He unzipped the suit pockets and had a look.

The dead man had two cards, one medical, and the other a Navy ID with

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

a Top Secret clearance, issued at MPacXXP, whatever that might be. Both cards were in the name of Martin A. Singer.

"The renowned Dr. Singer," Edel muttered. "How nice to meet you after all I've heard—"

Never mind. Nothing funny in this. Much as he dreaded it, Edel rolled the body over to compare the face with that shown in the ID picture. He had an idea this was not in fact Singer, but an activist who had stolen his cards for access to the orcas. It was surprisingly easy to see that he was wrong; Singer's face, though slightly distorted by death, was not bloated or otherwise affected by seawater. That meant he was recently dead. How recently?

Edel forced himself to unzip the suit and feel Singer's chest. The bloodless flesh was neither warm nor cold, yet the ocean temperature was forty-eight or fifty degrees. Singer had died in the last hour or two. Edel looked at the sky. He had heard no shots, and no boat or plane they could have been fired from. Singer's wound was high in the right shoulder. The bullet had passed through no vital organs, so Singer had probably died of shock and loss of blood. Depending on how hard he had tried to live, he might have been shot a long way from where he died.

Edel pocketed the cards and went to get a tarp to haul the body up the beach on. He buried it in one of the few sandy spots he had, and covered the grave with the biggest rocks he could carry. And that settled the matter. Had this been the body of a "whaler" with stolen IDs, Edel would have sent word of his death through the activist underground, sure that it would eventually reach the man's family and friends. No risk in that. The corpse being that of a man who was by profession an ethologist but by trade a Navy consultant, Edel decided he could do nothing but dig the grave and let him lie. He hardly needed to be accused of murder after all his other sins and trespasses.

Covering the grave settled nothing, of course. He spent the rest of the afternoon watching the sea from high up the cliff, brooding about murder. Activists do not carry guns. Singer had been shot by the bad guys, one set or another. Why? Because he had had a change of heart, and freed his captives?

Edel saw no whales, killer or otherwise, and at dark he drove to a motel on the edge of the village of Big Sur, where there was a public telephone. He called a friend who belonged to a splinter group of the Greenpeace splinter group Sea Shepherd—a splinter group so spontaneous and extremist that as yet it had no public name—and asked if anything was known about Singer's current assignment as consultant. The answer was not helpful: he was living near Monterey, writing a textbook, in retirement at the age of forty-two.

Edel's next call was to information. They had a home number for Singer, and Edel called that. A woman answered after the second ring. Edel said, "I'd like to speak to Dr. Singer, please."

"Who's calling?" the woman said, and he heard in her voice both caution and disappointment. She had been waiting for a certain call, he thought, and it had not come. Edel wanted to hang up right then, afraid to tell her the call would never come. But that was im-

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

possible, as was lying, so he said, "My name is David Edel. He doesn't know me—"

"Oh, but he does, Mr. Edel. We both do. I'm his wife, Anna," the woman said, and her voice became almost cheerful, as if he had good news after all.

"But I've never met him, or you."

"No, but we've read about you. And I know one of your attorneys, Roger Guillory. I'm an attorney myself. I imagine Marty's—tell me, are you calling from a safe phone?"

Edel thought the question was melodramatic, but then he remembered the dead man on his beach. "A pay phone. Is that safe enough?"

"Yes. Give me the number and I'll call you back in ten minutes."

Edel waited in the booth, in case someone drove up to use the phone. After eleven minutes, the phone rang. That was plenty of time to jump to the obvious conclusion and start to worry about its consequences: Singer's wife —now his widow—had been expecting him to call, if Singer did not. Singer had been coming to see him.

"The FBI was here yesterday," Anna Singer said after Edel had said hello. "I don't know for a fact that they're listening on my home phone, but they probably didn't believe me when I said I couldn't guess why Marty—you know."

"No, I don't exactly. Where is he?"

"Didn't he contact you? Isn't that why you're calling?"

"Why I'm calling is tough to explain. It might help if you tell me—what he'd contact someone like me for? To him, I'm a criminal, or a nut, or worse. A traitor. Right?"

"No, not anymore. Something happened in the training he's been doing for the Navy. And he's a bigger criminal now than you were. But haven't you seen him?"

"I've seen some orcas. Was he training orcas?"

"Yes, but the work was so secret that's all he'd tell me. Not even what changed his mind about it. He just told me he had to free them—hide them, actually."

But when had freeing dolphins become a capital crime? What kind of animal program could be that important? Edel stared at the empty highway and thought how much easier it would be to tell Singer's wife over the phone than in person that she was his widow, and then could not get the words out. He said, "These must be his animals. I think you ought to come down here —tomorrow, if possible."

She was silent for a few seconds, perhaps afraid to bring up the subject of death directly. She said, "How did you know they were his animals, if you didn't talk to him? Why *did* you call me?"

"Orcas don't come around here everyday. Especially orcas with collars on them. And, I talked to a couple of people before I got your number. I still have my contacts among the criminal element."

Though none of what he said amounted to an answer to her questions, each statement taken individually was true, the only strategy for a man who knew he was a poor liar. Nothing but the truth sounded convincing from him, and for

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

her part, Anna Singer was willing to be convinced. She agreed to drive down in the morning. "I'll leave early, be there around eight."

"OK," Edel said, and started to give her directions, but her husband had already done that for her. All she needed was the precise location and description of the mailbox at the top of his road.

Edel drove home. Tomorrow would be rough, but preferable to many more days of guilt had he given her the bad news cold over the phone.

He always left one light on outside his house when he was away at night. Tonight he had done it in hopes it might attract the orcas as well as guide him down the road. But after he arrived he sat in his car and listened for their sounds in the silence between breakers, and heard nothing.

He slept a few hours and was up well before dawn. Thick fog and no wind limited the distance sound would travel, but he went down to the beach anyway and waited for daylight, listening, and rehearsing what he was going to say to his guest.

A gray morning, as usual. The fog bank retreated, if on little cat feet, one paw at a time. The breakers appeared, then the edge of the kelp beds. No orcas, though. The fog stopped its retreat after a half mile or so, standing like a wall of billowing gray cotton on the surface of the ocean, a wall higher than the cliffs.

Disappointed, Edel hiked up the road, or started to. He heard a car easing down the first switchbacks in low gear, so he knew she had found the turn-off. He waited where he was, and soon saw a Volvo station wagon on the switchback immediately above him. It turned the last hairpin, and came creeping toward him, the face of the driver obscure in the morning shadows. Nervous, he looked out to sea, and the orcas were there, circling in and out of the edge of the fog bank, blowing, their black fins against the gray too far away to count.

The car stopped, and a thin blonde woman dressed in levis and a turtleneck sweater got out. She looked at Edel inquisitively, without smiling, and said, "I hope this is the right place—"

"Unfortunately," Edel said. "If you're Mrs. Singer."

"Anna Singer, yes. Why is that unfortunate?"

Edel offered his hand. A quick shake, and he said, "Because I found a dead man—being carried by orcas—those orcas—"

She looked in the direction he pointed and said, "How did he die?"

"He'd been shot. They were carrying—two of the orcas were carrying him between their flippers. He was wearing a wetsuit, and his body was not really cold. I don't know when he was shot, but he must have died just before I found him."

"He almost made it." She frowned. The frown deepened, and Edel realized she was about to cry. She said, "Marty's animals were always very loyal to him. What does this man look like?"

"Like his picture," Edel said, and handed her Singer's ID cards.

"This is why you called me. You knew he was dead last night."

"I couldn't tell you over the phone."

"No, not if you're—thank you," she said, beginning to cry. "I was afraid he

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

hadn't made it—no word, three days since he left—''

Edel would not presume to try to comfort her, to touch her, a perfect stranger. He could find nothing to say, either. Grief was an emotion that embarrassed him.

She took the IDs and got back in the car. For a moment he thought she was going to leave. Instead, she sat staring at the cards until she stopped crying. Then she got out and said, ''Where is he?''

''On the beach. I buried him. I'll show you where.''

''Please.''

They left her car there. As they walked down the road they watched the distant orcas so they would not have to look at each other. She said, ''Why don't they leave? They're free.''

''They know your husband's here, and they don't seem to understand death. Among themselves, I mean. And that would probably apply to any humans they were close to.''

''Or they're not as intelligent as some people think.''

''Maybe, but I'm glad they're back. They left me yesterday before I could cut their collars off.''

''And you want to do that now?''

''Yes, before the cops arrive.''

''Did you call them?'' she said.

''No. I was assuming you'd have to, being a lawyer and all that.''

''It can wait. I know who shot him, a guard or a watchman, or something. Finding the people actually responsible will take time, and even then nobody will go to jail for it. Marty was the criminal. But I want them to tell me, what makes freeing orcas a capital offense?''

''I was wondering that myself,'' Edel said. ''And—besides orcas, did your husband ever work with real whales?''

''Like gray whales? Not to my knowledge, but so much of what he did was classified that—who knows? Officially he wasn't doing any work for the Navy anymore.''

''Right. The reason I asked, the orcas have a sperm whale traveling with them. It must be a Navy animal, too.''

''What would they train a sperm whale to do?''

''Destroy sonar equipment? Sperm whales can produce extremely loud sounds—''

''And the military mind can produce extremely strange ideas.''

''Yeah,'' Edel said. ''Anyway, seeing the whale with the orcas is impressive, close-up.''

''Are you inviting me to go along? To see—what Marty died for?''

''And to help me finish the job he started.''

''Why would I care about that? I don't think the job was worth the risk, not of his life. Maybe later, if I can figure out what went into his decision, I'll change my mind. Right now, they're only animals he took too seriously.''

Edel nodded. Much as he disagreed, he could not argue with her. He led her along the beach to her husband's grave. She knelt beside it and wedged the IDs between two of the rocks that covered it. Edel was afraid she might want to have a look at him—an attorney could have seen a lot of corpses, he thought, especially if she worked in criminal law—but after several minutes in silence she pulled some of the tiny blue flowers that grew down the cliff and put

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

these on the grave, too. When she turned to Edel she had tears on her face, but her voice was steady.

"Do you have a boat, or do we have to swim out to them?"

"I've got an inflatable. You know, the Greenpeace Special. Perfectly safe, unless you hit a storm."

"Or a Russian whaling ship?"

"Yeah, but you don't find many of those off Big Sur. Rarer than orcas."

"OK, let's finish the job."

III

This time he was going out prepared. He took a variety of tools, along with food and a gallon of water, and topped off the fuel tank in case he had to stay with the pod all day to remove their collars.

During the run through the breakers, Anna sat in the middle of the boat, away from the spray. She moved forward as they reached the kelp beds and approached the fog, which, close-up, was like tattered curtains more than a wall, blowing toward them and receding, only gradually blanketing the Sun. The pod was circling into and out of the fog, a merry-go-round of killer whales. Edel followed them with his binoculars, and it hurt him when he saw that one animal had been wounded below its dorsal fin. Slightly rimmed with pink-white flesh or blubber, the wounds were circular and about the right size for bullet holes.

Had this animal been shot during the night, Edel thought, or was I too excited to notice the wounds yesterday? The victim swam as well as the rest of the pod, and while he wished he could do something to help heal it, Edel knew that large cetaceans often survived shootings, their vital organs shielded by layers of blubber. The wounded orca swam into the fog, and Edel counted the ones that followed until it came by again, for a total of eleven animals on the merry-go-round.

He handed the glasses to Anna, said, "One of them's been shot, too."

"Really? I'll bet that's the one Marty was riding," she said, and before she could raise the glasses to her eyes, her body tensed and she yelled, "Something white—big and white—under us!"

The plank bottom rang with clicks, and an instant later the sea exploded with orca, the animal broaching and blowing off to the right of the boat, far enough away that they were sprayed rather than drenched.

"Good Lord!"

Edel was a bit startled himself, but managed to laugh and say, "Big, is right."

He cut the engine. The orca did not sink to a normal swimming position to inspect them and the boat. Instead, he held his immense head out of the water as he would if he were playing periscope, to see the human world better, and he made the squeaky, rubbing noise Edel had heard yesterday.

"Is this an ambassador?" Anna said. "The leader of the pack, or what?"

"Don't know. He could be one of the two who were carrying your husband. He's big enough."

While this orca gave them a thorough inspection, the others circled deeper into the fog bank, and vanished. Then, swimming backward, the inspector moved slowly in the same direction. Edel did not start the engine to follow,

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

so the orca returned to the boat, squeaking and whistling.

"I think he wants us to go with him," Anna said.

"Yeah, into the fog. And I'm not a real sailor. Aside from how to use a compass, I know zero about navigation. If he deserts us a couple of miles out to sea, we could wander a long way north or south before I figure out where we are, or the fog breaks."

She nodded. "We'd have to trust him. Marty always said he would trust dolphins with his life, because nothing could harm him when they were around."

"I know what he meant."

"But he was wrong," she said.

Yes, Edel thought, wrong to be training captives. That was the mistake that had caught up with him, not the trust he put in the animals. And the way to prove it was to go with them. He said, "I'll take you in."

"To the beach?"

"Right. Then I'll see where they lead me."

She glanced at their would-be pilot. "If it would tell me what Marty was doing— OK, I'd better go, too. After a while I'd regret staying behind."

Edel smiled, and cranked up the engine.

The course was due west. Their pilot, taking up a position alongside the inflatable, was always with them, while the other animals kept ahead, hidden in the fog, their breathing and the sounds they made communicating with the pilot the only signs they existed. The party was complete when the blow of the sperm whale exploded across the orca noises.

"That's the whale," Edel said.

"I want to see it. Will the fog break?"

"Hard to say."

Occasionally they did pass through pockets of clear sky and bright sun, but the whale was not on the surface. Usually the orcas were, and, watching them, Edel began to tell some of them apart, by the shapes of their saddle patches and, with the males, the idiosyncrasies of their dorsal fins, the sags and ripples created as their larger fins bent under their own weight.

If the clearing was large, or stayed open longer than ten or fifteen minutes, all the orcas but the pilot would sound together. *They did not want to be seen*, Edel realized. In small clearings or partial sunlight, the pod spread out to fish. Once their prey was a shark, possibly a great white, though Edel was not certain because he only noticed its fin as three orcas attacked it together, raising a bow wave the size of a tuna boat's. The shark was in their jaws, and in pieces, before it knew the orcas were there, and before Edel could see how big it was. All the orcas flipped chunks of meat around, to share and to play with. One profusely bloody hunk a yard long landed in the boat.

They had both seen it coming and dodged it easily. Anna eyed it with what Edel considered surprising tolerance and said, "If that's a gift, would it be ungracious to throw it back?"

Edel heaved it into the water ahead of their pilot, who swallowed it in one gulp. "Evidently not."

As if to celebrate the killing, two smaller members of the pod leaped completely out of the water together, fifteen feet and several tons of happy predator

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

each, showing their pirates' colors. Supernatural or otherwise, these were spirits only a fool would dare offend.

"They are beautiful," Anna said. "And in this fog, they're like magic."

"Then let's call our friend here Merlin. It's past time for some names."

"OK. What about the whale?"

"I don't know."

After a moment, she said, "Thin Man. I still haven't seen him."

"Perfect. Dashiell Hammett would probably approve, too."

Edel expected that the pod would stop or circle while feeding, and give him an opportunity to cut some collars off, but they ate on the move. Whatever their business, it was urgent. On and on Merlin steered them, farther than Edel could calculate, though by noon he estimated they had covered twenty or thirty miles, and that if they went much farther they would not have enough fuel to get home under power. He did not mention that to Anna, and refused to worry about it himself. With one brief exception, Merlin was beside them constantly.

The exception came in the midst of heavy fog, as Merlin sounded, uttering a two-note cry that began as a squeal and ended nearly as a rumble. Edel cut the engine, and they could hear the other orcas breathing and squealing.

"Must have seen a particularly tasty fish," Edel said.

But it was not a fish the orca had in his jaws when he returned. The dark gray object Edel took from him was a plastic shard two feet long and lined on one side with a material like cork. Electronic circuitry was imprinted in it and sealed with a varnish or lacquer. It had no markings to identify its source, only a few numbers in places along the circuitry.

"Military hardware, maybe," Edel said as he gave it to Anna.

"From a shipwreck?"

"I guess so. What with all the search planes and ships in the area, that's what I was assuming had happened before the orcas arrived. Then I thought the search was for them, especially since I never heard anything on the news about a wreck, and I didn't think the Navy would try to keep it quiet unless it was a submarine. So now—it must be a sub."

"A nuclear sub?"

"That's about all we have anymore. Losing one this close to land would seriously embarrass the Navy."

"And it's some coincidence, if a submarine was lost about the same time Marty freed his orcas."

"What do you mean?"

"That it was lost chasing them, ran aground in shallow water, or something. Which got people mad enough to kill Marty."

It was plausible reasoning, though Edel would not have thought of it himself. That required a lawyer's mind, or a cop's. "A sub might be the best way to hunt for noisemakers like these, with all the sonar it has. Which makes me a little nervous."

"Because if they want them back that badly—"

"They won't give up. And we know how badly your husband wanted to free them." Edel looked at Merlin. "What is it you are trained to do, besides keep a low profile?"

Merlin had no time for talk, now that they had the plastic. He nudged the in-

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

flatable forward, his way of saying: start the engine. Edel did, and they got underway once more.

Merlin's agitation came from knowing he did not have far to go, for after a quarter-mile or so he sounded again. As he killed the engine Edel realized the other orcas had turned and were circling the boat. He saw nothing ahead but forty or fifty feet of calm water, dark blue almost to black, yet the sense of arrival was unmistakable.

Anna felt it, too. She said, "Why is this spot any different from the rest of the ocean?"

"You'd probably need sonar yourself, to know that."

Merlin periscoped up beside the inflatable with something new in his mouth, something thin and black. A length of electrical cable. Edel said, "What's at the end?"

Merlin's answer was an impatient rubbing noise from his blowhole. Edel said. "I wish we had a geiger counter."

"You think we're right over the wreck?"

"One way to tell," he said, and grabbed the cable. Merlin opened his jaws and sank into the water. Insulated with black rubber or plastic, the cable was thick as a man's thumb. Both ends were hidden in the ocean, but one was either attached to the bottom or went extremely deep, because he could not pull up any slack on it. In the other direction the cable was fairly light, and he reeled it in, though apprehensive about what he might find at the end.

With the engine off, the boat moved slowly along the cable as he pulled. Merlin circled, whistling. Edel's arms were tiring when he saw what the cable was attached to: a tear-shaped object about six feet long that might have been a buoy, though it was as unobtrusively black as the cable itself. Why design a buoy to float well below the surface? Or was this one defective?

There were cylindrical bulges along the surface of its long axis, and blister-like swellings on the curve of its upper half. For a metallic object so large, it was quite buoyant, defective or not; some of those bulging compartments must hold air. It had small openings like vents at the very top. Edel said, "This thing looks like a tiny submarine. Vents, ballast tanks, air tanks."

"So it can sink, and resurface?"

"Right. And I would bet that the only time it surfaces is to send a radio signal—somewhere. Maybe to a satellite."

He held the object against one of the inflatable sections of the boat, and they turned it around, searching for anything that would identify its owners. Its blackness was complete, except for a small red arrow near the top that pointed to a depression like the fingerhole for an access panel. Edel said, "What do you think? Open it?"

"Well, Merlin seems to think it's safe."

And you trust him, she might have added, but did not. Conceding that point, Edel pried at the hole. A hinge resisted with a squeak much like an orca might make, and then a section of the object's cover came up and revealed a compartment that held a telephone handset.

"No doubt about a wreck," he said. "This is an emergency buoy from a submarine. At least."

"And since the orcas led us to it—"

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

"You were right."

But not for long, he amended as he lifted the handset. Behind it was a metal panel imprinted with what he assumed were instructions, or data about the lost boat. He could do no more than assume, because the words were in the Cyrillic alphabet.

"That's Russian."

"Just like the boat it's attached to. In American territorial waters. Jesus, talk about a provocation."

"A Russian wouldn't be chasing the orcas," Anna said, apparently indifferent to international affairs. "Was Marty shot because Merlin showed him this, too?"

"But then why isn't the place swarming with *Federales*? Why are they all inshore?"

Anna shook her head. "No explanation makes sense entirely."

"Maybe the Navy doesn't know about the wreck, and the Russians are too scared to tell them," Edel said, but he knew it was unlikely that any submarine was noiseless enough to penetrate US defenses this far. Of course, passing unchallenged was no proof the submarine had passed unnoticed. It could also mean the Navy had preferred to let it pass rather than reveal the capabilities of those defenses. The great game. A much greater one than military intelligence had been in Kipling's day.

The quiet, foggy sea was ominous. *Some*one besides two civilians in an inflatable boat—and a pod of killer whales—should be here. What's wrong with this picture?

He hesitated to use the phone, dreading what he might hear, because it had occurred to him how the orcas must have found this device, how they would have heard the sounds of a vessel breaking up, of men dying, or of men still alive but aware they were going to die. Men who had been abandoned. Overcoming his dread, Edel lifted the phone, and heard the flat silence of a dead line.

"Nothing," he said, and handed the phone to Anna. As she listened, he inspected the compartment for switches, thinking that power to the phone might not be on.

No switches.

They waited, taking turns listening for several minutes, while the orcas circled and the day grew lighter. Visibility increased until they could see the pod, and soon after that everyone but Merlin sounded together. Edel put the phone in the buoy, but before he could close the panel, Merlin—who had been periscoping to watch what his humans were doing—gave out an extremely high-pitched whistle, obviously upset.

"Is somebody still alive down there?" Edel said, picking up the phone again. The whistling stopped, and Merlin sank down to a swimming position and worked off his emotions by moving away a few yards and slapping the water with his flukes.

The line was no longer dead. Edel heard a hiss and a crackle, and then a man speaking incomprehensible words in an excited, breathless voice, almost sobbing.

Somehow, nothing was ever as bad as you anticipated it would be, Edel thought. If this man, and maybe others, had survived since the submarine had sunk, they might last long enough for the Navy to rescue them.

The voice was so loud that Anna

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

could hear it, and she said, "Merlin was right. And patient."

"Yeah, but now we've got to tell this guy we're going for help. You speak Russian?"

"Are you kidding? It sounds like a record running backwards to me."

The voice stopped. Beneath the hissing of the line, Edel heard other voices, much softer than the first. A conference? Then, after a brief silence, "Hello. Americans?"

"Sure," Edel said. "What would you expect?"

"Is it the American Navy?" the voice said, sounding tired, relieved, and, surprisingly, a bit cagey.

"No, but we'll go get them. They may be able to rescue you."

The conference in Russian resumed. Anna said, "Is he translating for somebody else?"

"Must be."

"Hello, Americans. Go back from the antenna."

"You mean this buoy?"

"The antenna you are speaking from with the phone. You understand?"

"Yes. Go back to where?"

"A short—" the voice paused, as if its owner were considering how to put the distance in English. "A hundred feet? Maybe?"

"Why?"

"It will be dangerous," the man answered calmly, like someone who had come to a difficult but irrevocable decision. "Go back."

The line was dead. Edel dropped the buoy-antenna overboard. "He says to lay off a hundred feet. Something dangerous is about to happen."

"Dangerous? Like they're going to blow themselves up?"

He started the engine. "Or try to raise the boat, or fire off a few ICBMs. I've had plenty of experience with Russian seamen. They're capable of anything, and whatever they do, it won't be done delicately—or accurately, either. A thousand feet sounds better than a hundred."

He settled for two hundred. Merlin followed, but Edel could not guess where the other orcas and the whale were. If this dangerous stunt harmed them, the people responsible could forget about rescue.

The first hint that the stunt was underway came from Merlin, when he stopped vocalizing and worked his sonar furiously. Then the rest of the pod suddenly surfaced nearby, swimming two and three abreast. They were silent, except for the sound of their blows.

"Well, they're out of harm's way, at least," Edel said. "Now only the whale may be—"

The sea behind bulged, and frothed with huge bubbles, and in the middle of this eruption a long, bulbous, metallic gray vessel surfaced, sections of buoy cable draped across it.

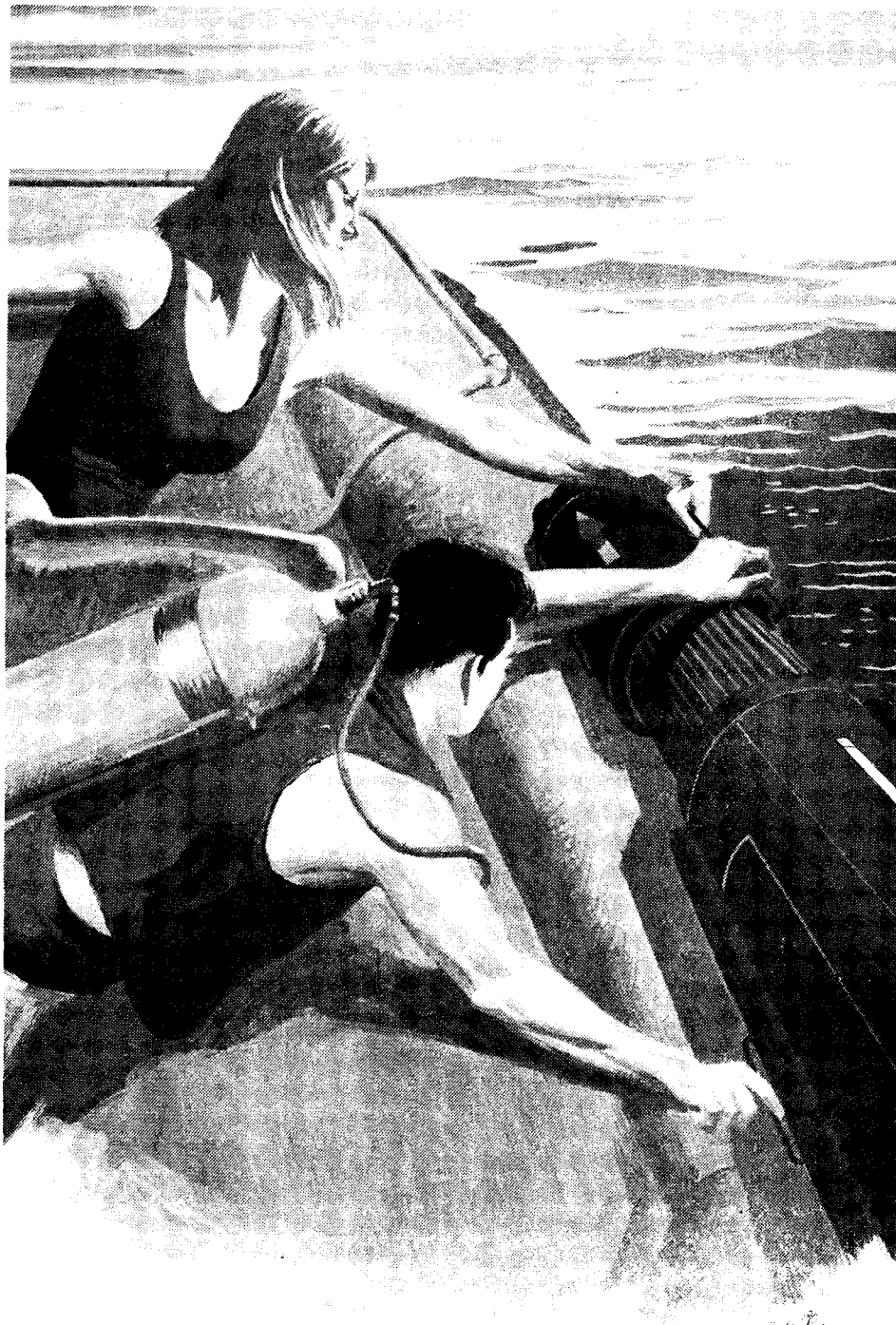
"Something new under the sun!" Edel said.

"What?"

"An escape capsule, in a military submarine. The boat that sank must have been absolute top secret, maybe experimental. The Navy will love this."

The capsule appeared to be in trouble. The bubbling and foaming around it did not die down, but rather intensified, and the vessel settled unevenly, one bullet-shaped end in the air. A hatch opened,

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED



LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

only a few feet above the water, and crewmen were immediately climbing out and leaping clear of the hull.

Edel turned the inflatable around. He hoped he had enough room to rescue everybody. He was just getting underway when the orcas rushed past him, and he smiled. Like most dolphins, they could sense if humans were in trouble, and he was sure they were going to help crewmen who could not swim.

The Russians, though, screamed in fear when they saw the orcas' fins, and tried to get back to their sinking escape capsule.

"What's wrong?" Anna said. "Do they think the orcas are sharks?"

"Any seamen ought to know the difference, even submariners," Edel said, and shouted at the Russians to stay calm, that these were dolphins, not sharks. He hoped at least one man understood him and would translate for the rest.

"But they look kind of hostile to me, too," Anna said. "They're not whistling. No friendly noises at all."

And they were moving fast and straight, as if for a kill. Edel shook his head. Remembering his confrontations with whaling ships, he thought that something like justice would be served if the first humans to be attacked by orcas were Russians, but no, it would not happen.

Horrified, he had to watch as it did. The orcas hit the swimming crewmen as brutally as they had hit the shark that morning. Bodies and severed limbs flew into the air, trailing blood. Anna screamed, and cried, "No, no, no—" and turned away.

Edel had to watch as he gunned the motor and headed into the inexplicable slaughter, too short of breath to shout to the orcas to stop. He suspected he was going into shock himself, and tried to calm down.

Because the orcas had turned aside rather than risk hitting the capsule, a few men had survived near it. Now nothing but the end of it was high enough to offer shelter, and the orcas were coming around from the other side, anticipating that this too would soon be gone. The surviving crewmen were screaming at Edel, splashing toward the boat, but he could not clear his head to decide where to go first until he heard, "American! Here!" and turned instinctively toward the sound of English. With Anna's help, he pulled the Russian on board. Gasping but unbloodied, the man lay huddled on the planks while Edel and Anna pulled two more survivors to safety. No one else made it, because a swell broke over the capsule and drove it down, and the orcas rushed in. Though they did not threaten anyone in the inflatable, they ignored Edel's screams and killed the four—the last—survivors in the water.

The sea was as red as if a whale had been harpooned, but Edel had never witnessed anything so stunning in brutality. These predators had been trained to forget natural behavior, all right, and with a vengeance.

The tip of the capsule rose out of the water once, then vanished for good. Merlin came up beside the boat, periscoped and whistled, curious to know why his friends had robbed him of three of his prey. Though none of this was the orca's fault, the sight of him turned

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

Edel's stomach. He leaned over the side and threw up.

Merlin watched sympathetically.

IV

Mountains three thousand feet high lay behind Edel's beach, but even with the fog dissipated the air was so misty that seeing and steering by them from this far out to sea was impossible. He would need help for at least ten or fifteen miles, and so he did not try to discourage Merlin when the orca took his position as pilot again, ready to guide the inflatable home as if it were all part of the day's work, his primary mission accomplished.

White-faced, Anna watched the orca, appalled not simply by the fact of murder, Edel thought, but the knowledge that these were Marty's animals. Edel wished he could say, "There's no blood on his hands. Obviously this is why he turned outlaw, this is what he didn't want to happen." That would have to wait. With one Russian certainly capable of understanding English, Edel could not say anything to reveal that he or Anna knew the orcas' history.

The other two survivors, besides showing no familiarity with English, seemed also to treat the one who had as if he were an officer and they were ordinary seamen, but the plain gray uniforms they all wore lacked emblems of rank or organization. The three at first declined offers of food and water. Vlasov, the English speaker, said they had had plenty of supplies in the capsule, and it was evidently a point of pride that they could be trapped underwater for a few days in a wrecked submarine and come up no worse for the experience. Eventually they did take some fresh fruit, and drained the water bottle.

Vlasov offered no explanation about his rank or duties on the submarine, and of course nothing about the reasons for its being here or the nature of the boat itself. He looked as close to a state of shock as Edel felt, until he noticed Merlin was piloting them.

"These are not your animals?"

"No, not at all. My work has been to free animals like them."

"But they are with you. Did you free them?"

"No. I saw them near the beach —where I live—and since this is not usually where they're found, I went out to watch them. That is, Anna and I did. Her husband's profession has been as a scientist who studies animals."

"Someone trained them to kill. You see the straps."

"Yes."

"But they were free, and they brought you to us?" Vlasov said. His tone of voice implied that something about Edel's story did not add up, but he was graciously willing to blame it on his own uncertainties with a second language, for now.

"Yes. To rescue you, I thought—"

"Obviously not! But you could not know what they were, as we did."

"What does that mean?" Anna said.

"We knew they were killers! It was they who sank us, you see."

"Orcas?" Edel said. "That's impossible."

"They sank us! They attacked the lifeboat on the way up, we heard them again, but they could not harm that one."

"But they could harm a submarine?"

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

"They, and a whale! The whale had a bomb!"

"No," Edel said, and on any other day he would have laughed. "A bomb would kill them, too."

"My friend—you must be my friend, you have saved my life—you were not with us."

Anna said, "What could orcas do, though?"

Vlasov told them, in fits and starts, with prompting to supplement his classroom vocabulary. Edel's imagination could fill in the gaps and put the story together.

The submarine had been cruising at 800 feet, 7,500 tons of—another point of pride for Vlasov—the quietest boat in the Russian Navy. She kept her active sonar emissions to a minimum, preferring to listen passively and have any American boats nearby reveal themselves by their electronic signatures. And, listening, she heard the expected, natural undersea sounds, from the faint rumble of geologic forces to the clicking of shrimp and the whistling of cetaceans. Indeed, she recognized the first burst of medium-frequency clicks that hit her hull as the echolocation pulses of an inquisitive dolphin, and did not react as if the encounter was anything special until the screams began. Eerie, metallic noises like discordant violin music, they could be heard easily through her double hull, and they showed up on oscilloscopes as multi-frequency pulses with repetition rates above 5,000 per second. The screams blanketed the sonar spectrum, effectively deafening the boat's ears, and whatever was making them refused to go away.

Because the likeliest culprit was a dolphin, the submarine could avoid it by diving deeper. With a depth limit also unequealed in the Russian Navy —Vlasov would not reveal the exact figure, only that it was more than 3,000 feet—she had plenty of margin for safety. She took on additional seawater as ballast, and began her descent.

The screams gradually faded away, to be briefly replaced by a noise never before heard on that boat, an echoing deep-toned vibration—bzzzzeeee, bzzzzeeeeeee, bzzzeeeeee—that Vlasov imitated well enough for Edel to recognize it from recordings he had heard, as the orca's hunting call. The submarine sank farther. The vibrations stopped abruptly, leaving her ears open, and what they heard was completely unexpected, the faint but unmistakable, rumbling hiss of cavitation.

A surface moving rapidly through a liquid will leave pockets of vacuum at its trailing edge—a phenomenon called cavitation—when the liquid cannot immediately fall back to fill the space vacated by the surface. Every external part of a submarine is engineered to minimize this effect, because vacuum pockets produce noise when they collapse, and noise is the enemy. Propeller design especially is the art of coping with cavitation, and the single, seven-bladed one that drove Vlasov's pride was a marvel of silence. Or had been. Now it was as noisy as a tugboat's. Worse, the problem extended to the propeller itself, surrounding it, and with her propeller beating against a medium other than water, the boat was losing way. And that meant she was sinking even faster than intended.

The water lately taken on had to be

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

ejected again, but downward momentum was too great to be stopped without forward motion, and the propeller, with almost no load on it, was spinning so fast that the motors driving it, also spinning too freely, were overheating. They were slowed in hopes that this would allow the impossible bubble around the propeller to collapse. The boat sank deeper, passing 2,000 feet.

More ballast was ejected, and the rate of dive slowed. The sound of cavitation disappeared. The motors were speeded up, and as forward motion began again, yet another new sound wrapped itself around the hull, a mournful bass howl, an equally untuneful oboe to take the place of the earlier violins. The crew had heard whale songs before, though not this loud. At 2,900 feet, the nose of the boat suddenly dropped, as if tons of new ballast had been taken on, and she sank straight past 3,000 feet. By the time the additional weight just as suddenly vanished, she was below her operational limit, and several of the many pipes that passed through her pressure hull started to leak, letting in water that could not be pumped out. The moment when her condition became terminal, and crewmen scrambled for the heavier-hulled escape capsule, was marked by a roar like a sonic boom, felt as much as heard, and the force of it, magnified by the weight of the water around her, caused pipes to burst. Heavier and heavier, she went deeper, to crushing depth.

Vlasov again imitated the hunting call. "Today we heard that, and our blood was on ice. We knew they were killers!"

Edel did not have a chance to correct his metaphor. Anna said, "I still don't see how. If something went wrong with your propeller, and then there was an explosion."

"Nothing was wrong with the propeller! It was beating against air, you see. The dolphins had let the air out of their lungs, under our submarine."

"But air isn't vacuum—"

"Compared to water, it is," Edel said. "A propeller can't push against it. I heard about a dolphin in the Irish Sea who learned that trick all by himself. He drove fishermen crazy. Their boats would stop dead in the water for no apparent reason, engines racing and everything."

"So has your Navy heard of this dolphin?"

"Maybe. Or some military genius thought of it independently, like the invention of calculus. Which must be an inter-species first."

As well as the perfect way to deal with clandestine missions, he said to himself. Neither noticed nor challenged, so far as the Russian Navy could tell, the submarine would have officially been lost to an act of God, not an act of war. A weapon so subtle, one that doubled as a normal part of the undersea environment and could approach an intruder without arousing suspicion—and leave the scene of the crime the same way—was virtually no weapon at all, unless someone survived to name it. And with Navy trainers guiding the orcas instead of civilian sightseers interfering with them, nobody would have, not even with an escape capsule.

"You are a professor?" Vlasov said to Edel. "Or is it that you talk like one?"

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

"I suppose I do talk like one, sometimes. Why?"

"It is not right to—to take up mathematics now. Or biology. What has happened is war! Your Navy—"

"Is no worse than yours," Edel said, anger clearing his mind. "But they'll probably be a lot less academic than I am about stuff like war and peace and exactly what the hell you're doing here in the first place—when I turn you over to them. I know they'll have a real practical interest in your boat. I assume it was nuclear powered and carried nuclear missiles, and that the whole poisonous monstrosity is now fouling up *my* ocean?"

Vlasov surprised him by smiling. "I wish to talk to someone in your Navy. I, and my seamen, know much your Navy likes to hear. Maybe they will allow us to stay in America, for that information?"

"You want to defect?"

"It is why we came up! Our Navy has not answered our SOS. They left us. What is your opinion?"

"About a deal?" Edel said, glancing around the horizon. The sky was still clear, and, unnoticed, the other orcas had sounded. A second intrusion, to rescue the survivors of the first, would be madness. Vlasov knew it, and that was the real reason he had come up.

"Yes, a deal."

"It might depend on whether you—what kind of message did you send with that floating antenna?"

"A very fast emergency signal. Our position, nothing more."

"Nothing about dolphins?"

"No."

"Then they'd probably let you stay, especially if your submarine was as new as I think it was—"

"Very new."

"That's good, for you. Welcome to Amer—"

He was cut off by the noise of the pod surfacing together in a tight circle around the boat, almost nose-to-tail. The Russians dropped to the floor of the inflatable. Anna screamed, and for the first time in his life, Edel was frightened to see dolphins. He yelled, "Hang on!" but it was impossible to hear any answers over the blows and squeals. The boat rocked in a confusion of wakes, and he gunned the engine to steady it.

The orcas were not interested in the boat or its passengers. The circle reformed as two lines, Merlin shot to the front, and they all raced off toward the northeast, swimming with a mission.

Edel turned and followed, already fifty yards behind. He said to Anna, "If we lose them before we see land—"

He looked at the sky again. It might stay clear the rest of the day. "We'll steer due east, and with luck, we'll see land before dark—"

He paused as the inflatable bucked across a slight swell. The sea had felt perfectly calm at a reasonable speed, but now every wavelet was an obstacle.

"—and after that I can steer by the lights of the highway and house lights on both sides of my place. But Merlin's the best guide we have, if we can catch up with him."

"What are they after, another Russian sub, a rescue party, like he says?"

"Can't be," Edel said, telling half the truth. "Too risky."

The other half of the truth was that rescue for Vlasov and his comrades

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

would have to come from the west. The only nuclear-powered, missile-carrying prey the orcas would find in this direction would be American. "It just can't be," he said, but so softly nobody heard him over the noise of the engine.

V

The gap between boat and orcas widened. Each time the inflatable slammed across the top of a swell, the fleet of dorsal fins was farther away. Finally, the sea was empty. The pod had sounded.

In the area where the orcas had last been visible, Edel cut the engine. All was quiet. He explained to Vlasov that Merlin was the only true navigator available, but the Russian—nervousness making his use of English more oddly idiomatic than before—tried to talk him into heading east regardless.

Edel waited. After a few minutes, the regular "whoof whoof whoof" of blows came from the north. The pod was circling a hundred yards away. Edel closed the distance by half, and cut the engine again.

Merlin swam to the boat, made two laps around it in greeting, then started to return to the pod. Edel noticed that he and all the others were silent but for sonar pulses, and that their breathing was more rapid than usual, evidently in preparation for a deep dive. Anna noticed it, too, and said, "They're getting ready to go after something."

"Yeah."

"Do you have a gun?"

"What? No, of course not. I've never shot anything in my life."

"This would be a good time to start. That's what Marty should have done, if he couldn't—"

She hesitated to finish, with Vlasov listening, but Edel could guess what she meant to say: if he couldn't control their training. But he could control *them*, so they were in no danger as long as he was with them, and alive.

And, "Nobody ever takes the possibility of his own death into account when he makes plans," Edel said.

"No."

He looked at Merlin. How had Singer controlled him? The most obvious and effective way to trigger a conditioned response in a cetacean would be with sound—a word, a whistle, maybe even music. What signal called the orcas off a hunt?

Merlin let out a quick breath, suddenly arched his back, and a split-second later he was flipped nearly head-over-flukes by a burst of displaced water, and with a blow that sent spray forty or fifty feet into the air, the sperm whale broached beside him.

There were several exclamations in Russian. Anna said, "My God, look at that!"

"Kind of puts Merlin in perspective, doesn't he?"

Vlasov said, "We *must* leave!"

"Why?" Anna said. "I don't see any bombs on him. He doesn't even have a collar."

Spray blew across the boat, and they had to hang on or be thrown overboard by the wash from the whale's arrival. Edel saw an expanse of green-brown skin, heavily wrinkled in places, and caught the smell of hot, meaty breath on the wind as the whale blew again, and again, and a dozen times more. Water surged around and over his blow-

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

hole, carrying away a foamy wake of oil.

Sperm oil. Another perfectly natural item of the ocean environment, and—as Edel had realized when Vlasov told his story—the only residue of a "bomb" that could not be seen and needed no harness to be carried.

Nineteenth-century whalers had believed the oil in a sperm whale's blow could burn human flesh. Lacking electronic listening gear, they had no idea the oil could be far more damaging when housed in the whale's forehead, in the spermaceti organ that produced it. Capable of aiming sound pulses so narrowly that at their focus they had more energy than the roar of a jumbo jet at take-off, the oil could in fact be deadly for the unlucky target, whether the giant squid that was the whale's preferred dinner, or a submarine too deep to withstand any degree of further pressure.

At the moment, Edel could tell none of that to Anna, who watched the behemoth intently. Edel thought the whale's size had spooked her again just as she was recovering from the shock of murder. He felt uneasy, too. The whale dwarfed the inflatable more than he did Merlin, and an untimely twitch of his flukes could upend it. As Merlin had been forced to do, Edel gave the whale some room.

When Merlin completed his detour the pod made a few more circles and sounded together. The whale remained on the surface, blowing continuously. Oil settled on the boat, and though it had a sour smell it was obviously harmless.

"How long can he stay underwater?"

"As much as an hour," Edel said. "Big whales like this can—damn. You hear that?"

A shrill buzzing vibrated in the bottom of the boat, far higher in pitch than sonar clicks. Angry and irritating, it was unlike anything else produced by a cetacean, and it made the Russians nearly hysterical.

To head off a mutiny, Edel was about to move far enough away to leave the noise behind, but as if the buzzing was his cue to join the game, the whale sounded and the buzzing faded away.

"That is what we heard, the sound! We must leave now, or we will be killed!"

"It is scary," Anna said, "And meant to be that way, right?"

"Yeah, their hunting call, what they use to herd whales—and other dolphins—into a circle for slaughter."

"They will begin killing—"

"Not us," Edel said to Vlasov. "But if they kill someone else, or try to, we have to stay and look for survivors."

"You have no room for more!"

"Sure I do, as least a couple. Calm down."

"There must be a submarine right under us," Anna said. "See all the air they're breathing out?"

It was obvious what she meant, a line of bubbles that crossed in front of them at a right angle, extending southwest and making good speed.

"Let's hope our subs know about these animals, and don't try to dive," Edel said, starting after the bubbles.

They followed the trail until it thinned and stopped. The orcas were not out of air, though, for they stayed underwater. Instead, the sea parted more violently

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

than when the whale had broached, and the forward part of a submarine shot into the air at an absurdly sharp angle, then slid back down in slow motion.

Edel gunned the engine and put the nose of the inflatable into the wash and rode over it. The submarine settled evenly on the surface, showing no intention to dive. Lying directly ahead, perhaps fifty or sixty feet long, its hull was oddly shaped, short and fat, roughly like a football. It had a sail at the extreme stern that was square and stubby, equipped with almost vestigal diving planes. Edel saw no markings anywhere, but it had to be American. Something this small could not have traveled from a Soviet base in the far east.

The orcas came up for air, and immediately surrounded the submarine, their hunting call even more disturbing when heard clearly on the surface. A hatch opened in the top of the sail, and the angry noise stopped. Edel heard music—classical music—on the breeze from the direction of the sail. The orcas had been called off the hunt by—

"Bach," Anna said, "The Brandenburg Concertos."

"Yes," Vlasov said. "Wonderful."

Edel supposed the Russian was talking more about the change in the orcas' behavior than about the quality of the Navy's music, for they were obviously happy, squealing, leaping, slapping the water. Greeting the submarine. A man climbed out of a hatch in the hull, and tossed things to the orcas. Anna had the binoculars on him, said, "Fish. He's rewarding them."

"This sub must have been used in their training," Edel said. "From the shape of it, I'd say it's a deep diver."

"Which means—yes, damn it. Ted Corwin."

"What?" Edel said.

"The fish man, one of the people Marty worked with."

"So we're not innocent bystanders now, if he sees you."

"Right. And here's somebody else. Don't know him. Navy uniform, gold on the collar, an officer."

"American Navy?" Vlasov said.

"You bet," Edel said. "Who else would be training orcas to sink Russians?"

"OK. We will talk."

Edel stared at him. "For a military officer, you're pretty quick to cut a deal."

"I am the *political* officer. I am a member of the Party. All submarines carry one of us."

"To keep everybody from defecting?" Edel said. He cared little enough for brass hats, but a Communist Party hack was even closer to the bottom of the evolutionary scale. Except that he and Anna would end up in custody, too, Edel would happily have delivered the Russians to the submarine and been done with them.

"They see us," Anna said.

"Probably heard the engine on their way up."

One of the men on deck was waving, and giving them unintelligible orders through a bullhorn. Edel yelled, "Buzz off," and headed in the opposite direction. This disturbed the people on the submarine, and Vlasov as well, but Anna said, "Can we get away from them?"

"Don't know. I do know that boat can't be very fast underwater, and prob-

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

ably slower on the surface, since it looks like it's purely for research. But we can outmaneuver it forever," Edel said, and grinned. "Like old times."

He headed north and passed the submarine at a hundred yards, then turned due east. Vlasov stopped complaining, said,"See! The killers are after us, we must go back!"

Edel had heard no commands from the submarine, but the orcas had reformed into lines and were swimming in their general direction. The decision to follow the inflatable might have been Merlin's, born of the responsibility he apparently felt to pilot Edel home, but if that was so, his trainers should have stopped him rather than risk losing the pod a second time. They could call in a search plane to track the inflatable.

"We must go back! Why do you run?"

"Because their sub-sinking program is about as top secret as you can get, and any civilian who knows about it is in trouble."

"But they will think *we* are trying to escape," Vlasov said, and glared at Edel as if he were contemplating mutiny again. The other Russians, ignoring an argument they could not understand, nervously watched the orcas approach.

"I'll send them a postcard and clear your name," Edel said. "You'll still cut your deal, if not today or tomorrow, then next week, or next year. *We* have to get to shore, right now."

Vlasov turned to his seamen, but before he got more than a few words of Russian out, Edel interrupted, "Believe me, Comrade Party-Member, it's a simple trick to flip this boat on its back and put us all in the water, and I'll give you a demonstration if you interfere with me."

"But the killers—"

"Have a sweet tooth for Russians only. I know because I've already been swimming with them. So relax and enjoy the fresh air. Won't be any where the Navy hides you."

The orcas were ten or fifteen yards behind. The Russian seamen timidly asked Vlasov a few questions, and he answered them while gesturing at Edel. He must have included the threat to overturn the boat, because they said nothing more, and the fear in their eyes almost made Edel feel guilty. Vlasov also was silent, hanging on as the boat bucked and swooped across the afternoon swells.

The orcas divided into two lines as they reached the boat, one line along each side. The lead animals moved ahead until their bodies were fully past the boat, and then they slowed to match its speed. Edel kept to his course rather than waste fuel trying to evade them, and so found himself surrounded when Merlin surfaced directly in his path.

Spray flew from all directions, thrown up by the orcas' violent passage through swells. Edel was sure that few people had ever seen so many large cetaceans moving at such speed together, and even fewer, if any, had had the chance to be racing along in the midst of them. Despite everything, he was laughing, exhilarated, until the animals edged closer and their wakes made the ride so rough that the boat was in the air as much as it was on the water. He still tried to maintain his speed, but Merlin, by gradually slowing, left him no choice but to do the same. Running straight up the

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

orca's back and slashing it open with the propeller was no choice at all.

Merlin slowed further. Edel slowed, too. He looked at the Russians. They lay in the bottom of the boat, cowering out of sight of the orcas. Slower. Slower. Merlin was barely moving. Edel said to Anna, "The fun is over."

"I know," she said, her voice more resigned than angry. "You are just like Marty. You wouldn't hurt them to save your own life."

"Yeah. My epitaph."

The pod collected around them, two and three deep. Edel had no room to move the boat, and stopped trying. The training submarine wallowed along behind them, laboring through what really was no more than a light sea. Though the sub was too far away for any sound from it to reach the orcas, their behavior suddenly changed. They fell quiet, and drifted away from the inflatable, and—after bursts of sonar clicks—sounded.

In the complete silence that followed, Edel wondered what he should do. Anna said, "They're after something."

"Beeeep-beep. Beeeep-beep."

Edel scanned the ocean. No orcas. He looked forward at the Russians. The beeping came from Vlasov. Edel crawled to him, said, "What's that?"

Vlasov said something in Russian, his eyes closed. Edel shook him. "Get up, they're gone. What's that noise?"

"Beeeeeee—"

It was coming from something in Vlasov's shirt pocket. Edel unbuttoned it and reached inside. Vlasov opened his eyes and, ignoring Edel, spoke to the seamen. They got to their knees and cautiously peeked out of the boat.

The noise was made by a cylindrical black object the size of a roll of coins. Edel said, "What sets this off?"

Vlasov did not answer. Edel waved the cylinder in front of his face. The Russian glanced up at the sky and said a single word in his native language.

"Does that mean a satellite? Is this to tell you that another sub has arrived?"

Vlasov smiled, a *no comprendo* smile. Being surrounded by orcas again had sent him deep into shock and scared his English right out of him.

The orcas surfaced, swimming in two lines, and began their deep-breathing routine. Helplessly, Edel yelled at the training sub to start playing Bach, but it was too far away still for anyone to hear him, and too far away for him to go to it, get the tape machine or whatever they played their music on, and bring it to the orcas. Too far, too late.

The orcas went down for the kill, their hunting call causing Vlasov to curl himself tightly against the floor.

VI

Trailing a cloud of diesel exhaust, the training submarine came within shouting distance. Edel told the men who were out on the sail, "There's a Russian sub down there!"

A Navy officer yelled back, without a bullhorn, "What? Russian? How do you know?"

"Because I've got survivors from the first one you fools sank, right here, and one guy's got a beeper to tell him!"

"Russians? You have Russian military with you? Bring them over!"

"Only after you play some Bach and call off the orcas!"

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

"They can't hear us underwater!"

"Well, damn you, why not? You never heard of hydrophones?"

"Don't you—who are you, Mister?"

"What does that matter? You people are about to start World War III!"

"*We* didn't turn them loose! Some crazy—bring those Russians—"

The sperm whale cut him off with a "whooooooof," as it broached behind the submarine. Edel said, "Well, stop him, anyway!"

"We can't, his conditioning is controlled by what the orcas do! If you won't bring them, let them swim—"

"Swim? These guys wouldn't swim in a bathtub today! What do you think happened to the rest of them? Your orcas had them for lunch!"

"*What?*"

"They killed a couple dozen men from the sub they sank! That surprises you?"

"They were trained to kill subs—titanium subs—not people! They must have generalized to the crew—Mister, you're in violation of the National Security Act! Bring those—"

The whale was breathing for a deep dive, too. Edel was so furious and frustrated he said, "Can't you stop him any way at all? Can't you tranquilize him?" though he knew it would mean the whale's death. Cetaceans do not breath when tranquilized.

"No! It would kill him!"

"Yeah, right!"

Further demands for surrender were interrupted by blows somewhere ahead of the sub. The pod had come up before the whale could find them. Edel said, "Play the damned record!"

Someone did, and the orcas turned toward the sub. Edel sat back against the engine, relieved, ready to make a run for shore again. He said, "I wonder what happened."

"False alarm?" Anna said. "Or the submarine evaded them."

Edel glanced at Vlasov. The political officer's eyes were open, blinking, as if he were waking from a nap. "Or our friend and shipmate really did send a message home about dolphin attacks, and lied to us about it."

"At least we won't have to witness any more murders."

What happened next happened fast, and began with a rushing, bursting noise. A sudden movement at the periphery of his vision, well ahead of the submarine, caught Edel's attention. He jerked around and watched a long gray missile leap from the sea through a cloud of steam and hang in the air not quite as long as an orca might—a snapshot of disaster on the wing—before it shot out a tail of flame, came level, and flew, a few feet above sea level, toward the training sub.

"Jesus Christ! Dive! Dive!" came from the sail, and that was all, or all that Edel heard before he hit the gas and yelled, "Hang on!"

The airborne torpedo, or whatever the missile was, took a few seconds to gather speed, but that was only a fraction of the time needed for either the inflatable or the training sub to get out of its way. A terrific explosion of foul, burning gas slammed Edel in the back, and threw the boat end over end, away from the sub. He hit the water face first, stung by its icy temperature as much as by the impact. When he came up, he realized he was deaf, for he could hear

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

nothing but a powerful ringing, not even the sounds he made treading water.

He saw a second explosion rise from the smoke around the sub, and ducked below the surface. He felt the shock wave pass, heard not a whisper from it. Probably the sub's fuel tanks, he thought. That's that.

He came up for air. Billowing smoke lay across the sea between him and the sub. "Fine," he said aloud. "You guys are even, now you can call off the damned war."

He heard his own voice, carried the short distance through his jawbone, as if from far away, but it was a good sign. Maybe he wasn't completely or permanently deaf.

A worse problem was the flesh-creeping cold water. Where was the inflatable—and where was Anna? And the orcas?

The boat was easy to find, flipped over with the weight of the engine counterbalancing it so that it stuck into the air at a slight angle, several yards farther from the sub. One of its sections was going limp, though, losing air.

He rolled over on his back to swim toward the boat. As a swell dropped behind him he saw Anna and the two Russian seamen coming the same way, but he did not see Vlasov, dead or alive. Neither did he see the orcas. It was probably premature to worry about them, as they had been a good distance from the sub when it exploded, but the whale had been right alongside and he saw no sign of it.

He let Anna catch up with him. As they swam together to the boat, she pointed to one ear and shook her head, and Edel nodded. The Russians were close behind, and they all reached the boat at the same time.

It was not quite a wreck, though the loss of one air section would reduce the load it could carry. To compensate for that, Edel could jettison the engine, which was dead weight now that it was drenched. Certainly that would have to be done before they could right the boat, so while the Russians clung to oarlocks and held him steady, he worked underwater to free the engine from its mount. Because everyone was deaf, they did not know they had company until a swell much larger than normal washed over them, and turned out to be the bow wave of a surfaced submarine.

A strange submarine, presuming its design was military. Edel had never seen anything like it. Forward of the sail, the sub was essentially a trimaran; along each side of the narrow main hull was an oval object half its length. And, instead of showing a sleek, hard-shelled surface, these trimaran objects were textured, or rippled, or wrinkled. It was hard to decide what word best described them, impossible to guess what purpose they served. The nationality of the craft was established immediately, though, as the Russian seamen abandoned the inflatable and swam toward it, waving and—Edel thought he could hear them—shouting.

He looked a question at Anna: you want to be saved by them? She shook her head, and as he watched her trembling lips form, "No," he had to admire her courage. "Right," he said. Watching his mouth in turn, she nodded. They stayed hidden behind the inflatable.

The submarine slowed. Crewmen on the sail waved at the swimmers and

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

threw them a line. Edel, with his teeth clenched to keep them from chattering, and numbness spreading from his toes up his legs, had to wonder if he and Anna had made the right decision.

The Russians had made the wrong one, though. Before they could reach the line, several dorsal fins appeared in the area between the inflatable and the submarine. Four, five, six of them. The men on the sail waved more vigorously, possibly shouting warnings neither the swimmers nor Edel could hear. As the orcas were about to hit the swimmers from behind, Edel looked away. Nothing could force him to watch, this time. He and Anna huddled together, and he felt his extremities shrink beyond what the cold had done to them. He hoped the orcas could still tell friend from foe.

A pop-pop-pop broke through his deafness. He thought at first it might be a sign of further damage to his ears, then realized, as the sound continued in a staccato rhythm, that he was actually hearing—though very faintly—automatic rifle fire. He looked back at the submarine. The sea near it churned with crisscrossing lines of miniature geysers, as several men fired from the sail, but pointlessly. The orcas were gone, and so were the swimmers.

He and Anna cowered behind the engine for what thin protection it might give from stray bullets. Had the orcas been hit? Killed? And were those six all that had survived the explosions? Though his own instinct for survival said to worry about what the orcas might do to him and not what the Russians had done to them, it hurt him to think they might be dead.

The submariners fired directly at the inflatable, probably for no reason but frustration, as the bullets tore only through the upper half. Had they seen and wanted to eliminate two American witnesses to their destruction of the training sub, their aim would have been better. Still, their shots punctured the other air sections, which began to sag. When the firing stopped, Edel went to work on the engine mount again, Anna anchoring him with one arm.

His hands were numb, the boat was sinking deeper as air blew out of the bullet holes, but he finally got the engine separated from its mount and it dropped away. He and Anna peeked out from under the now-deflated inflatable sections. The Russian submarine was gone, and all that remained of the training sub was a thinning cloud of smoke.

No whale, no orcas.

They grappled with the boat to flip it over so they could climb onto the flooring. The oars were still strapped in place, but trying to row home would be out of the question, even if the boat were seaworthy. They were too cold, and miserably exhausted, to try. The boat being wrecked, they had no choice but to cling to the wreckage and hope that the training sub had notified its base that they were here, or that any rescuers the Navy sent to look for survivors of the explosions would find them instead.

Once they got it topside-up, the flooring floated an inch out of the water. They held on to an oar and hung side by side, gathering strength to pull themselves up. Edel reached forward to hook his fingers in some bullet holes and felt a hard object in his shirt pocket, pressed between his chest and the blade of the

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

oar. He reached in the pocket, found Vlasov's beeper.

He could not remember having kept it, and his first impulse now was to throw it away. They did not need any Russians tracking them down before the Navy did. But, with all the submarine's crew dead, would the Russians even pay attention to the device? Edel hoped not, because he foresaw a use for it. If and when he and Anna were rescued, and detained in government custody, they would probably be accused as Martin Singer's accomplices. Saving the beeper and turning it over to the Navy, so it could be taken apart and any communications codes programmed into it deciphered, would earn them some good will, if it did not convince the *Federales* they were model citizens.

He buttoned the black cylinder up in his pocket, and then, as he groped again for bullet holes, he noticed the sky had turned gray. The fog was returning. Rescue might be delayed.

He felt something touch his feet. He jerked away, and Anna screamed, a faint sound that was also painfully loud. A second touch, and pressure beneath his feet. An island was rising out of the sea, an island that had to be an orca.

They held on, motionless. Though Anna appeared to be terrified, she did not panic, perhaps understanding what kept Edel calm: if the orca had meant to kill them, they would already be dead.

They rose higher, standing on the animal's back, until they were submerged no deeper than their waists, and lunged onto the boat. And there they collapsed, capable only of breathing and shaking, embracing the wonderfully solid wood.

Four orcas surfaced gently around them. One was Merlin. He and a second animal had bullet holes in their backs. For this, and the fear and anger and frustration of the day, Edel began to cry. Despite his wounds, Merlin periscoped beside the boat and had a close look at the two humans. Then he dropped out of sight, came up with the mooring line in his mouth, and carefully got the boat moving toward shore.

VII

The four orcas, the survivors, knew a boat was approaching well before it could be seen through the edge of the fog bank. They had waited for it between the place it would appear, and the beach where Martin Singer had left the sea.

The boat, a dinghy, was manned by six sailors in gray uniforms, four of them rowing. They paused when they saw the killer whales, as if wary of what the animals' intentions might be. The dinghy carried no weapons, but neither could it be associated in the orcas' minds with a recently killed submarine. Watching the seamen through a three-inch telescope he had bought for whale migrations, Edel saw them stare up at the house, and him, and he smiled. "You're on your own, Comrades. Talk to the animals."

Standing beside him, Anna said, "*Are* they Russians?"

"Same uniforms. Have a look."

Without the telescope, he saw the oars dip and rise cautiously, slowly. The dinghy came a little closer to shore. The orcas lay becalmed, slightly to one side

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

of its path, because the dinghy was pointed toward the section of beach where Edel had buried the beeper. The very thing he had thought least likely to happen two days ago, had happened: a Russian naval party had chased him and Anna down, and evidently intended to land on a patch of American coast to confront them, in the certain, open violation of some sort of military etiquette, if not in fact the commission of an act of war. Of course, acts of war were becoming routine in these waters, Edel said to himself.

"What do we do?" Anna said. "Call the Navy?"

"The Navy already knows. This is so blatant, they must have been talking to the Russians on the hotline, and the Russians told them they had a way to find us."

Anna stepped back from the telescope, said, "You're assuming the Navy was notified about us, that the training sub radioed our description—"

"Sure, and this proves it. Also, you've turned up missing, like your husband. And as for me—hell, they know me. The only question is, why Russians? Why not our swabbies, or the FBI, or the CIA?"

Edel followed the dinghy with the telescope as it inched past the orcas, who were lined up all four abreast. In a gesture that clinched American complicity, one of the men who was not rowing tossed fish to them. Edel could not tell if the gift was accepted, but once the boat was clear of them, the orcas turned and trailed it until it reached the breakers.

"I didn't see any guns, at least," Anna said.

"No, and that's another reason I think they have permission for this. Brass hats are touchy about *armed* invasions."

The dinghy rode well up through the breakers, like a lifeguard's boat. Edel hobbled over to the couch, where he had been sleeping so Anna could have the bedroom, sat down on the rumpled bedclothes and slowly put his boots on. He had slept most of the time since Merlin towed the boat home, and though his ears had recovered from the explosion, the rest of his body still ached from it, and too many hours of cold.

Anna pulled one of Edel's jackets on over her sweater. She said, "They wouldn't go to all this trouble just to reclaim a beeper."

"No, but there are simpler ways to assassinate us, too. That's why I'm going down to talk to them, to see what's on their minds—on everybody's minds."

"You mean they made a deal. About us and the orcas."

"That's my guess, yeah."

The Russians had hit the beach, but not far. Their dinghy rested on gravel above the surf line, and the oarsmen, ordinary sailors by their caps, sat beside it and enjoyed the sun. The other two had walked several yards toward the house, and were waiting for Edel and Anna. Apparently officers, they wore odd, short-brimmed hats that looked like relics of Czarist days. The taller of the two, blond and pale-eyed, had a thin face and the vulpine features that were purely Slavic. The second officer was dark-haired, and his blunt face reminded Edel of a mole or some other type of burrowing mammal. Tall-and-blond said, "Good morning."

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

Edel nodded. The Russian went on, "You seem fit, after your—adventure."

"Fitter than your crowd, Comrade—"

"Better that you do not know our names."

"OK, I'll call you what I like—Comrade Lenin," Edel said to the blond, who actually smiled and said, "As you wish."

"And you—Comrade Molotov."

The Mole's eyes widened a bit. A political reaction, Edel wondered, or was his English good enough to catch the pun? Anyway, the proceedings were off on the proper, disrespectful note.

"Well, then," Lenin said, "you have an object that is the property of the Soviet people's government. We ask you to return it to us."

"It's salvage, came from a wreck."

"Yes, yes, but as a gesture of good will—"

"My gestures don't cover good will," Edel said. "What will you give me for it?"

Lenin smiled again, as if to show he understood that Edel understood what the visit was really about. "The animals," he said, "The dolphins."

"You don't own them," Edel said.

"We are acting as—agents—for those who do," Lenin said. "The animals may—"

"Why does the US Navy need agents?" Edel said.

"You can imagine why," Lenin said. "Can't you?"

"So they can say none of this happened. That they never saw us. And no congressional committee can call Russian citizens as witnesses."

Both officers smiled. Happy days. Lenin resumed where Edel had interrupted him, "The animals may remain free, and live here if they choose. That is the offer, for our property, and your silence."

"Something for everyone," Edel said, and though he was sarcastic, he knew the deal was done. He would accept any conditions that left the orcas free. "But especially for you, since the orcas are no threat to any new subs you send over, with the whale dead. And how much plutonium is the wreck leaking? How many warheads did it carry?"

"None, not nuclear warheads," Molotov said. "The boat was an attack submarine. Our missile submarines, like yours, are kept close to home. And the reactor is heavily shielded. It will not poison the water."

"Titanium," Lenin said. "Extremely strong. The hull, too. Only we use that metal in submarines, you see. Only we have the technology for it."

"But dolphin sonar can tell the difference between echos from titanium and echos from steel," Edel said. "So your technology becomes a weakness."

"Yes," Lenin said. "It is how they were trained to recognize our boats as the enemy. And why, really, your Navy wishes to have the animals free—to be certain we will *not* send any new boats here."

"They *are* still a threat," Molotov said. "We have been given a briefing about this program."

"So have I, from a victim of it. Vlasov told me—us—exactly how his submarine was sunk."

"You did talk to him?" Lenin said. "You did not take our property from his dead body?"

"We talked to him. And even if the

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

whale had survived, your boats would be perfectly safe as long as they didn't go deeper when the noise started. You know that, if you've been briefed."

"But before the noises, they—" Molotov said, and glanced at Lenin, for permission to continue. Edel thought.

"What?" Edel said. "Vlasov said the attack began with the noises. Something else happens first?"

Pride seemed to be struggling with secrecy in both officers, the same pride Vlasov had shown in his marvelously quiet boat, the same pride Lenin himself had displayed in Russia's titanium technology, the pride of a backward tribe that, for once, had got the jump on their cultural betters. And they wanted to tell somebody about it.

Lenin said, "You realize, the US Navy did not mean to sink our boat. That was an accident."

"Yeah, an accident," Edel said, and he saw Anna nod in agreement. If their briefing had not included Martin Singer, the Russians would hear nothing of him now.

"It could only be an accident, because the US Navy *did not know the boat was there*."

"Right. Vlasov was quite proud of how quiet the boat was, especially the propeller. Japanese?"

"What Vlasov told you—the propeller is unimportant," Molotov said. "Vlasov kept some secrets, I think. The propeller was not moving when the dolphins arrived. The boat was—"

He paused for effect, and also to look at Lenin again.

"The boat was sailing," Mototov finished. "On the currents that move where layers of cold and warm water meet."

Furled sails, Edel thought. That's what the trimaran objects on the second submarine had been. He said, "Nice trick. But aren't those currents kind of slow?"

"Slow, yes," Lenin said. "But fast for tactical uses, eighteen to twenty-five kilometers a day. Have you heard a nuclear reactor under full power? It is like a hot samovar—a pot—bubbling and boiling. One can hear it many, many kilometers away. So, nuclear submarines dash to their stations, reduce power, and float there, to be silent. And of course the enemy knows where the boat stopped, and knows it cannot move. It is not truly hidden. But with sails, our boats *can* move, in silence, and they can vanish. In three months, a boat will travel down all your coast."

"Or stop part way, to confuse things," Edel said.

"Yes, exactly."

"So before the dolphins make noise, they—"

"Attack the sails," Lenin said. "The sails go more than a hundred meters to each side, and must be made of very light plastic. The animals shred them, the boat loses way, and it is forced to start its propeller. Then the noise, the boat goes deeper, and so on, to the end."

Lenin pointed out to sea. The orcas were lined up, waiting for the dinghy to leave. "These four can still find our boats, and rip the sails, and make us bring our reactors up to power, to give away our positions."

Edel saw a more immediate threat: what if the orcas attacked the dinghy,

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

and killed these secret agents? Would that cancel the bargain? But all he said was, "Vlasov did keep some secrets."

The Russians responded as if this were a compliment. Sure he kept secrets, Edel thought. So he could cut his own deal for defection.

"As you stated—and now you see how true it is—our agreement has something for everyone," Lenin said.

"Yeah. Wait here, Comrades. We'll get your 'property' for you."

"As you wish."

Edel and Anna limped up the beach. The beeper lay under a pile of sand along the way to Martin Singer's grave. As he knelt to uncover the device, Edel noticed that Anna had gathered fresh flowers from the hillside for the grave. He said, "What about him? And you? Can you agree to secrecy?"

"Maybe. It's what Marty would have done, isn't it?"

"Definitely."

"And we found out why freeing orcas was something you could get killed for. Really—when I think about what the animals could do, it was too dangerous to try."

She shook her head. "But like you said, he wasn't planning to die."

"No."

"OK. I'll take my vow of silence—for now, for Marty's orphans."

"Thank you."

The Russians accepted the beeper as formally as they would have if it were what the negotiations were all about. After Anna and Edel agreed to the rest of the arrangement, Lenin wound himself up to make a concluding statement suitable to the harmony of the occasion, but Edel cut him off. "You have any appointments to keep, Comrades?"

"I don't understand," Lenin said.

"Are you in a hurry, or could you spare a few minutes more to help us with something?"

"Perhaps. What is it?"

"Well, the orcas are wild animals now, not someone's property, and they have to look like it, don't they? Which means they can't be wearing collars. And as my boat got wrecked in the late unpleasantness—by a Russian missile—I thought that to cement our good relations, you might like to take us out to the animals in your boat so we could cut their collars off. What do you say?"

While both officers stole nervous looks at the waiting line of killer whales, and exchanged brief words in their native language, Edel heard Anna mutter, "I don't believe you."

"Good will and harmony," Edel said. "And maybe lunch."

"No!"

"Kidding, just kidding. OK? Violence is what I hope to avoid."

"OK. Your sense of humor takes some getting used to, you know?" she said, but she smiled.

As Edel expected, the Russians had thrown their pride around too much to refuse his request. Any reason they might offer could be interpreted as a frightened excuse to avoid the orcas, and their invasion would end in a retreat rather than a successful withdrawal. Lenin said, "We will be happy to help, to seal the agreement."

"Swell. Let me get some tools, and then I'll be happy to introduce you to your new allies." ■

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

brass tacks

Dear Dr. Schmidt;

The cover story in the October issue was definitely a "good read." *Sparrowhawk* was exciting, with good, believable characters and a good story line. On that basis, I enjoyed it.

But . . . I'm not sure that the story works in "suspending my disbelief." Here's why:

1. I know it's a picky little point, but I'm an amateur birder, and it ticked me off. Chickadees aren't vegetarians as Mr. Easton states. Their primary diet is insects and insect eggs. They come to our feeders to supplement their normal food source; even then, it's still advisable to put out suet (animal fat) for them.

2. I have a hard time thinking that people will buy something that requires "mucking out." By the way, even if you get ersatz pigs to eat the stuff, what do you do with ersatz pig droppings? "Matter is neither created nor destroyed . . . "

3. In my mind I have a real problem believing that a bird as big as a jetliner would still look like an enlarged version of a songbird. There would have to be some extreme structural modifications.

4. I could be wrong, but in my readings on genetics (I am an engineer, not a biologist), it seems to me that genes do not code structures, but proteins. The structures that proteins build are specific to the organism; similar body parts often have wildly different phylogeny. I don't think the story's "nip out and sew together" approach to genetic engineering would work. This is most noticeable with the "kangaroo pouch" on the ersatz jellyfish/airbag. A kangaroo doesn't have the same blood, circulatory system, etc., so how could its parts work in a jellyfish's system? I do think that someday we will be able to engineer organisms, but in a manner akin to designing micromachine complexes (which we are) rather than pasting parts together like an automobile body shop.

5. We build jetliners out of metal rather than wood or dried flesh because you get better strength/weight ratio with metals, even though they weigh more per unit volume. I think you would get the greatest chicken casserole in history if you strapped jet engines to a giant bird.

6. Birds aren't designed to fly that high, that fast. How do you protect their eyes against flying particles? What do they breathe at 30,000 feet?

7. Even if a giant bird could be made strong enough to handle a jet engine (metal implants alone won't help much), I have a hard time believing they would be economical. You are carrying all that useless weight (heart, kidneys, liver, bird's last meal, etc.), which would reduce its payload capacity greatly. Also, you must feed a live bird even if it is just sitting at the airport.

8. I must throw my engineering hat into the ring here. Instead of the "Superbird Scenerio," how about bioengineered organisms to "grow" the airframe? You could use a bone or cartilage-like substance, made stronger than a skeleton because it doesn't need to flex. You could then put the people on the inside instead of the outside. You could either keep it alive, but by a rad-

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

ically different design (many tiny, distributed organs rather than heavy central ones), or have it (them?) build the airframe, then die.

Like I said, I liked the story, and I like your magazine. Even though I don't buy Mr. Easton's vision of what large-scale genetic engineering would be like, it made me start thinking, "Well, then; what *would* it be like instead?"

PETE KOZIAR

Baltimore, MD

Dear Mr. Schmidt:

I read my friend Harry Stine's November 1989 "Alternate View" ("Technology Re-Transfer") with interest and amusement. Harry zeroed in quite accurately on the contradictions of US policy with respect to purchase and import of Soviet Bloc (is it OK to use the term in these days of glasnost?) military hardware.

Unfortunately, his aim was not as good with respect to my role vis-à-vis "America's 'Soviet Air Force.' " As much fun as it would be to be the Pentagon's "Marshal Aviatssi," alas, I can make no such claim. In the newspaper interview Harry quotes from, I was doing my job as the DoD's Deputy Director, Operational Test and Evaluation (Policy, *External Affairs*, and Special Programs)—emphasis added. A job not nearly so glamorous as Marshal Aviatssi, but someone's got to do it.

Anyway, I enjoyed my "15 minutes of fame"—for which, Harry, thanks. I only wish you had identified me as both an SF reader and an SF *writer!* I had a few stories published back in the '70s (my 15 minutes for that decade), and there are a few left in me, if I ever find the time to knock them out. Hmmm . . . maybe something about technology re-transfer from the Collectivist Union of Magellanic Despotisms . . . under the pseudo Marshal Aviatsii. . . .

KARL T. PFLOCK

Annadale, VA

Dear Dr. Schmidt:

In "The Hand that Rocks the Casket" by Timothy Zahn (Nov. '89) I immediately jumped to the conclusion that the Chilean government was changing the very minds and souls of people that died or were assassinated while the souls were in the traps, but I couldn't see any evidence of that in the story. This leaves General Miguel Diaz's assertion that the revived ones work for the country for a reduced rate out of gratitude, or the explanation that the alternative for them is to go back to being dead.

Having Dr. Sommer violently object to people working for a pittance out of gratitude is as unbelievable as presenting people who would. This doesn't make sense.

This leaves only the case in which people are forced to work under threat of death, which is really not an original idea, and has nothing to do with the soulminder technology anyway. If a government wants to enslave its people, they can do it much more inexpensively, or at least, in any number of different ways, like the way the USSR and many Warsaw pact and other communist countries do it. The soulminder technology is superfluous to the plot. If the Chilean government *had* come up with a way to mess with people's heads inside the traps, or even if they had found a way to read the traces and were blackmailing their victims (or even if going through soulminder was *shown* to cause incredible altruism), soulminder then would have been a necessary part of the story. Zahn didn't really write a soulminder story at all, and even if he had, he would still have only been rehashing

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

the tired old propaganda of the evil right-wing government where enslavement of its citizens is always possible.

Why do countries like South Africa, Chile, and even the USA stink when ones like the USSR who really, and not just in this kind of fiction, horribly abuse and enslave their citizens, are proclaimed as being peace-loving and avant-garde, just for making a few hesitant admissions, and mouthing all the right placating words? Why is the horrible racism and butchery in other African countries ignored in the South Africa bashing scramble? Is it because the perpetrators and victims there are both "only" blacks? There is a double standard!

JAMES WIEBE

Quebec, Canada

The author replies. . . .

I never meant to suggest that the victims of this gambit were accepting indentured servitude out of gratitude; they accepted it because those were presumably the terms under which they'd signed up in the first place. You could argue (as, indeed, *would* be argued in an international forum) that such an arrangement isn't that much different from paying an insurance company for medical coverage, except that here you pay with a year of your life instead of with equal monthly installments of cash. Sommer's objections to the idea are precisely the same reasons the government thought the experiment worth trying: given the uniqueness of Soulminder, it essentially sets the government in the position of God, with complete and absolute power over this particular aspect of life and death. At the very least, it's a perfectly legal—and ethically defensible—way to get a political troublemaker temporarily out of circulation without making a martyr out of him; at the best, a year's worth of unavoidable memories as to how his nation's leaders saved his life may subtly change his attitudes toward those leaders. Too subtle to be worthwhile? Perhaps, but that *is*, after all, why experiments are run.

I could try and answer the other points you brought up about the story itself; but I don't think it would be worth the time and space to do so. The minute I set the scene in Chile, it appears, your suspension of disbelief went skidding out of fiction and straight into international politics. So let me repeat, once more, what Stan has had to say time and again in these pages: this is a *story*. Not a model for governmental policy; not a suggested pattern for anyone's personal view of the world; not even a statement about right-wing versus left-wing atrocities: it's just a *story*. As it happens, I agree with you that left-wing atrocities are every bit as bad as right-wing ones, and that there are some really foul despots out there who've been generally ignored by the people who wave placards in front of embassies. But I'm not in the business of writing political treatises—I write stories, and stories have to be set *somewhere*. (And as for rehashing left-wing propaganda, by the way: did you happen to notice, on p.106, that three of the five countries quietly supporting this experiment were Bulgaria, Nicaragua, and the USSR?)

TIMOTHY ZAHN

Dear Stanley Schmidt:

Recently, I ordered a sample copy of *Analog*. I received the November issue and I was quite surprised to find an editorial like this in a Science Fiction Magazine. Honestly, I did appreciate your editorial very much, and I cannot resist the temptation to comment on it, although I intended to send you manu-

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

scripts of science fiction stories, not letters of comment.

My feeling is that you are too optimistic about the value of the data gathered by "experiments" consisting of building industries close to population centers.

First of all I would like to make clear why studies are necessary at all. If, for instance, a few weeks after the opening of a plant manufacturing depilatories the people in the surrounding areas lose their hair, the case is clear-cut and not much of an investigation is necessary. However, studies are necessary because effects often are quite subtle and can be found only after years of exposure.

As far as I have understood (I'm a physicist, not a social scientist) experiments in the social sciences (including medicine!) should be performed on a "double blind" basis. In your editorial you already mention that the studies of health effects on people should not be done by industry or environmental groups involved in the issue at hand. The studies should be performed by independent labs. But to obtain reliable data the conditions of the "experiments" must be even stricter: The researchers involved should not know which of the people investigated are from the area close to the source of pollution and which of them are from the comparison group. To fulfill this condition a conscious effort is necessary. If this condition is fulfilled you could call this situation "single blind."

However, to obtain the "double blind" situation, it is also necessary that the subjects under investigation are not aware of the "experiment." This condition is hard to meet, especially in a democracy, I think.

Of course you'll expect a solution from me for the problem I raised. Unfortunately, I have to confess I don't have one readily available.

FERDI SPIT
Vleutenseweg 186
3532 HP Utrecht
The Netherlands

As you say, some problems don't lend themselves to study under ideal laboratory conditions—you have to make do with data from the real world! That doesn't mean those problems should be ignored, but rather that the best use must be made of the available observations—just as astronomers and geologists have been doing all along.

Dear Dr. Schmidt:

I wonder if I could have the use of your soapbox for a few words?

* * *

Yo! Authors!

Us readers been noticing this creeping elephantiasis in the paback racks. Slender, sinewy novellas, even short stories, swoled up like a poisoned pup.

We know it's tough making a living at this, and the alternative to autoinflation may appear to be (gasp!) getting a job again. Still, at least three commercially viable ways to save Artistic Integrity (and verbal steroids) come to mind:

1) Package a name novella w/ ± related shorts, as in V. Vinge's superb "True Names."

2) Novella as half of a Tor double.

3) Big print. Thick paper.

"It's a sin to waste the reader's time"—L. Niven

(End of sermon) I finally got around to *Tweedlioop* and enjoyed it. Nice touches of moral ambiguity. A first-class piece of work.

PETER D. TILLMAN

It's not just authors—part of it is what publishers *want. And part of it is readers—if big books didn't frequently sell, publishers wouldn't keep buying them.* ■

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

Classified Marketplace

AN AUGUST/90

ANALOG/ISAAC ASIMOV combination CLASSIFIED AD rate is $6.50 per word—payable in advance—($97.50 minimum). Capitalized words 40¢ per word additional. To be included in the next issue please send order and remittance to I. M. Bozoki, Classified Ad Manager, DAVIS PUBLICATIONS, INC., 380 Lexington Ave., New York, N.Y. 10017.

BOOKS & PERIODICALS

STARSHORE

A Magazine For The SF Reader

featuring
hard & speculative SF and fantasy short stories

Subscribe Now!

☐ Add my name to the subscriber list (4 issues/$12.95)

☐ Check or money order enclosed or Charge to my ☐ Visa ☐ MC

Card # _____

Exp. Date _____

Signature _____

SUBSCRIBER

Name _____

Address _____

_____

_____

Outside USA add $4 per subscription. US funds only

Mail To: McAlpine Publishing, 800 Seahawk Circle, #116, Va. Beach, VA 23452 or call (804) 468-2969.

BOOKS & PERIODICALS—Cont'd

100,000 science fiction and mystery paperbacks, magazines, hardcovers. Free catalogs! Pandora's, Box AA-54, Neche, ND 58265.

COMIC Books 20% Savings, Discounted Backlists, Free Shipping $15 orders, Immediate Details: McKibben Enterprises, 1302 Catalina, Alamagordo, NM 88310.

CATALOGS & DIRECTORIES

ANALOG CATALOG ON COMPUTER! Complete cross-referenced index to all fiction and fact articles published in ANALOG between 1960 and 1989. 13 different categories listed: Author, Title, Theme, Your Comments, etc. A must for ANALOG readers! (Requires IBM/compatible & hard disk.) To order, send $40.00 (check/money order) to: ANALOG CATALOG, Davis Publications, 380 Lexington Avenue, New York, NY 10017.

DRAGONS

DRAGONS! T-shirts, sculptures, stationery, jewelry and much more. Full-color Dragon Catalog - $2.00: Dancing Dragon-ANO, 1881 Fieldbrook, Arcata, CA 95521.

MISCELLANEOUS

SCIENCE Fiction Roleplaying by mail? Free info - Twin Engine Gaming - Dept. AS, 3254 Mapleleaf, San Jose, CA 95121.

OF INTEREST TO ALL

JOIN the Science Fiction Fan Club! Computer programs, monthly convention calendar, articles and games. Subscribe now 12 issues $10.00 to: Shoestring Publications, Box 69056, Pleasant Ridge, Michigan 48056.

TAPES & CASSETTES

OLDTIME RADIO PROGRAMS. Great Science Fiction! Also, mysteries, comedies, westerns. Free catalogue. Carl D. Froelich, Heritage Farm, New Freedom, Pennsylvania 17349.

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

a calendar of analog upcoming events

3-5 August
RIVERCON 15 (Louisville area SF conference) at Holiday Inn Downtown, Louisville, Ky. Guest of Honor—Mike Resnick, Fan Guest of Honor—George Laskowski, TM—George Alec Effinger. Registration—$18 until 15 July, $25 at the door. Info: Rivercon 15, Box 58009, Louisville KY 40258. (502) 448-6562.

3-5 August
FAMILYCON I (SF, Fsy, and Science conference) at Holiday Inn, Timonium, Md. Sponsored by the Baltimore Metro Chapter of the National Space Society and the Baltimore SF Society. Registration—$20 adult, $10 child (2-12) until 1 July 1990; $25 adult, $15 child thereafter. Info: FamilyCon 1, 3309 Taney Road, Baltimore MD 21215.

3-5 August
AUGUST PARTY '90 (Star Trek™ convention) at Marriott Hotel, Tysons Corner, Va. Registration—$10 in advance. Info: August Party '90, 4625 Glasgow Drive, Rockville MD 20853.

11-12 August
FANEX 4 (media-oriented SF conference) at Sheraton Hotel, Towson, Md. Guest of Honor—Ray Harryhausen. Registration $12 until June 1. Info: Fanex, Box 6220, Baltimore MD 21206. (301) 665-1198.

11-12 August
UNICON '90 (media-oriented SF conference) at Sheraton Hotel, Concord, Calif. Fan Guest of Honor—Eric Hoffman. Registration—$40 ($25/day). Info: Unicon '90, Box 6004, Concord CA 94524.

24-26 August
BUBONICON 22 (New Mexico SF conference) at Clarion Four Seasons, Albuquerque, N. Mex. Guest of Honor—Jennifer Roberson, TM—Roy Tackett, Artist Guest—Harry O. Morris. Registration—$20 until 31 July, $22 at the door. Payments to NMSF Conference. Info: Box 37257, Albuquerque NM 87176.

23-27 August
CONFICTION (48th World Science Fiction Convention) at Netherlands Congress Centre, The Hague, Netherlands. Guests of Honor—Joe Haldeman, Wolfgang Jeschke, Harry Harrison; Fan Guest of Honor—Andy Porter. Registration—$85 until 15 July 1990. Supporting—$28 until 15 July 1990. This is the SF universe's annual get-together. Professionals and readers from all over the world will be in attendance. Talks, panels, films, fancy dress competition—the works. Join now and get to nominate and vote for the Hugo Awards and the John W. Campbell Award for Best New Writer. Info: Worldcon 1990, Box 95370, 2509 CJ The Hague, Netherlands. Enclose sufficient International Reply Coupons for airmail response.

30 August-3 September
CONDIEGO/NASFiC (North American SF Convention) at the San Diego Omni Hotel International, San Diego, Calif. Guest of Honor—Samuel R. Delany, Fan Guest of Honor—Ben Yalow. Registration—$75 until 1 July 1990, $85 at the door. Supporting membership—$25. Info: ConDiego, Box 15771, San Diego CA 92115.

31 August-3 September
UK NATIONAL STAR TREK™ CON 30 at Stakis Gardens Hotel, Bradford, England, U.K. Guest of Honour—Joe Haldeman. Registration—£25 attending, £10 supporting. Info: UK National Star Trek Con, Box 628, Bristol BS99 1TZ, England, U.K.

—Anthony Lewis

Items for the Calendar should be sent to the Editorial Offices six months in advance of the event.

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

BOOKS PASS QUALITY TEST, COMMANDER. WHICH 5 DO YOU WANT FOR $1?

WITH MEMBERSHIP

SEE BACK PAGE FOR MORE BOOKS

4515 *Aftermath, Uneasy Alliances, Stealers' Sky*
Spec. Club Ed. $12.98

4655 Pub. Ed. $18.95
Club Ed. $8.98

4572
Spec. Club Ed. $5.98

4705*
Spec. Club Ed. $9.98

4689
Spec. Club Ed. $5.98

4663* *Hyperion, The Fall of Hyperion*
Pub. Ed. $38.90●
Club Ed. $13.98

HERE'S WHAT YOU GET WHEN YOU JOIN . . .

5 BOOKS FOR $1. Send no money now. You'll be billed $1, plus shipping and handling, when your membership is accepted.

A GUARANTEE OF SATISFACTION. If you're not 100% satisfied with your books, return them within 10 days *at our expense*. Your membership will be canceled and you'll owe nothing.

THE FREE CLUB MAGAZINE. You'll receive 14 issues of *Things to Come* a year. Each issue includes 2 Featured Selections plus a number of Alternates from the Club's library of almost 500 books. Twice a year, you may also receive offers of Special Selections.

SHOPPING MADE SIMPLE. To get the Featured Selections, *do nothing*—they'll be sent automatically. If you prefer another book—or none at all—simply return your Member Reply Form by the date shown. A shipping and handling charge is added to each order.

AN EASY-TO-MEET OBLIGATION. Take up to 1 year to buy 4 more books at regular low Club prices. Afterwards, you may resign membership anytime. Or you may continue to enjoy the benefits of belonging to *The Science Fiction Book Club*.

HUGE DISCOUNTS . . . as much as 65% off publishers' hardcover editions. Club books are sometimes altered in size to fit special presses. All are printed on high-quality, acid-free paper.

RISK-FREE RETURN PRIVILEGES. If you get an unwanted book because your Club magazine came late and you had less than 10 days to decide, simply return the book *at our expense*.

THE Science Fiction BOOK CLUB®

MAIL TO: *The Science Fiction Book Club*
Garden City, NY 11530

Please write book numbers here:

YES! Please enroll me in *The Science Fiction Book Club* according to the risk-free membership plan described in this ad. Send me the 5 BOOKS I've indicated. Bill me just $1, plus shipping and handling.

Mr./Mrs.
Miss/Ms. _____
please print

Address _____ Apt. _____

City _____ State _____ Zip _____

17008 38

If you're under 18, your parent must sign here _____

Members accepted in U.S.A. and Canada only. Canadian members serviced from Canada, where offer is slightly different. Sales tax added where applicable. We reserve the right to reject any application.

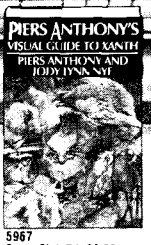
ANL 8/90

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

TAKE CONTROL.. GIVE US THE ORDER: SEND 5 FOR $1

WITH MEMBERSHIP

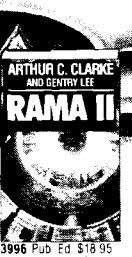
Use the other side to tell us which 5 you want to join with!



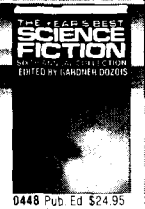
5967
Spec. Club Ed. $9.98

4440 Pub. Ed. $19.95
Club Ed. $10.98

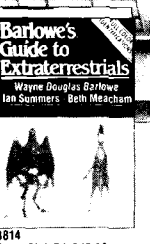
4069 Pub. Ed. $18.95
Club Ed. $9.98



3996 Pub. Ed. $18.95
Club Ed. $9.98



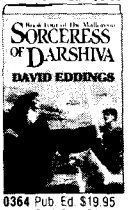
0448 Pub. Ed. $24.95
Club Ed. $14.98



3814
Spec. Club Ed. $12.98

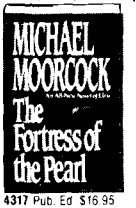
4283† Pub. Ed. $17.95
Club Ed. $8.98

1107
Spec. Club Ed. $7.98



0364 Pub. Ed. $19.95
Club Ed. $9.98

0133 Pub. Ed. $19.95
Club Ed. $9.98

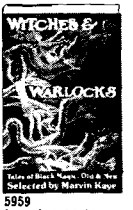


4317 Pub. Ed. $16.95
Club Ed. $6.98

4614
Spec. Club Ed. $6.98

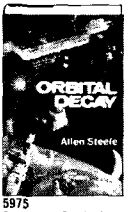
5413
Spec. Club Ed. $7.98

5991 Pub. Ed. $18.95
Club Ed. $9.98



5959
Spec. Club Ed. $9.98

4531 Pub. Ed. $17.95
Club Ed. $8.98



5975
Spec. Club Ed. $7.98

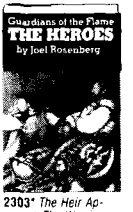
4499
Spec. Club Ed. $7.98

1420 The First, Second and Third Books
Spec. Club Ed. $8.98

7260 *Woundhealer's Story, Sightbinder's Story, Stonecutter's Story*
Pub. Ed. $45.85●
Club Ed. $8.98

1842 *Dawn, Adulthood Rites, Imago*
Pub. Ed. $52.85●
Club Ed. $12.98

4424 *Swords Against Wizardry, The Sword of Lankhmar, Swords and Ice Magic*
Spec. Club Ed. $12.98



2303* *The Heir Apparent, The Warrior Lives*
Spec. Club Ed. $6.98

7377 *Seventh Son, Red Prophet, Prentice Alvin*
Pub. Ed. $53.85●
Club Ed. $12.98

● Combined publishers' editions

* Explicit scenes and/or language

† Copyright © 1989 Paramount Pictures Corporation. All Rights Reserved.

THE Science Fiction BOOK CLUB

SEE OTHER SIDE FOR MORE BOOKS

LICENSED TO UHZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED